The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Vol. XXIV, No. 12 CHICAGO June 4, 1921

EDITORIAL DEPARTMENT—

Nathan C. Rockwood, Editor
Chas. A. Breskin, L. R. Croy } Assistant Editors

ADVERTISING STAFF—

Charles H. Fuller, Eastern Manager, 101 West 41st Street, New York City

G. J. Nelson
A. S. Barnett
Western Representatives

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ROCK PRODUCTS—

Geo. P. Miller, Manager
E. M. Gibson, Assistant Manager

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W. D. Callender, President.
N. C. Rockwood, Vice-President.
Geo. P. Miller, Treasurer.
C. O. Nelson, Secretary.

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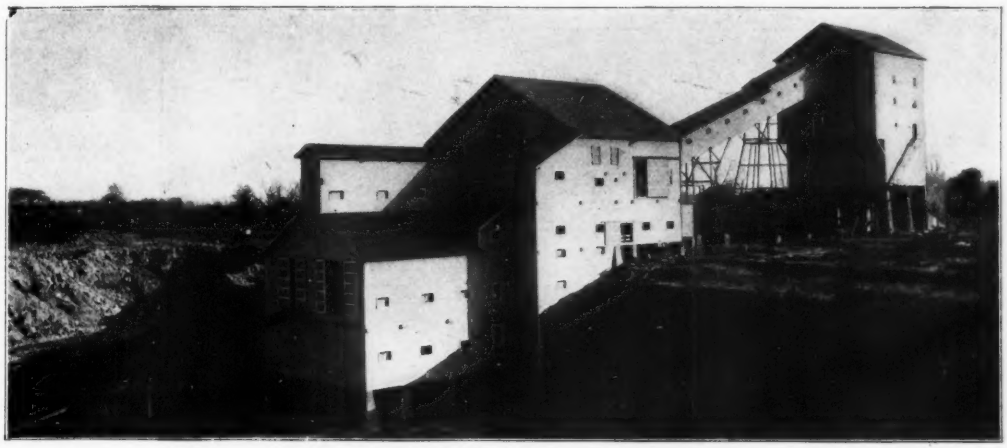
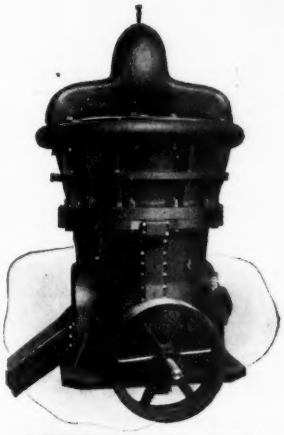
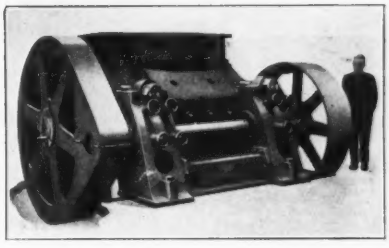
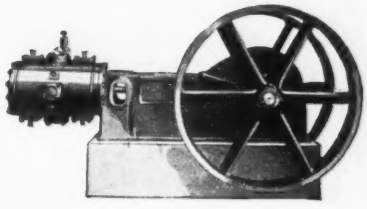






UNDIVIDED RESPONSIBILITY FOR ENTIRE CRUSHING PLANT EQUIPMENT



The many crushing plants which have been completely equipped by the Allis-Chalmers Manufacturing Company is evidenced by the satisfactory service which these plants are giving. The Allis - Chalmers Manufacturing Company takes the entire ***responsibility*** for the design of the plant and its equipment. These plants are built on the highest engineering standard following the best engineering practices.

Our Engineers are at your service to make complete installation drawings.

Write for our Bulletins

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

Patented feeding disc. Eliminate shovelers. Absolutely safe.

Crawlers used on B-G Loaders for nearly two years. No experiment.

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Digging and loading direct from the bank the B-G Loader fills trucks or wagons at the rate of 3 yards or more in 3 minutes. Note that the loader requirès no planking, whereas the truck obviously does.

The B-G Loader fills the gap between the shovel gang and the steam shovel. It offers the most economical means of loading at capacities ranging from 25 to 500 yards a day. It costs about half as much as a crane, and it can pay its way on even a small job by the great saving it achieves in eliminating hand shovelers.

Names of the user whose pit is shown above and of many others who are doing similar work with B-G Loaders will be furnished if you want them.

We have an interesting folder, "Sand and Gravel," Bulletin "V," which describes several sand and gravel handling installations. Write for it today.

Barber-Greene Company

AURORA, ILLINOIS, U. S. A.

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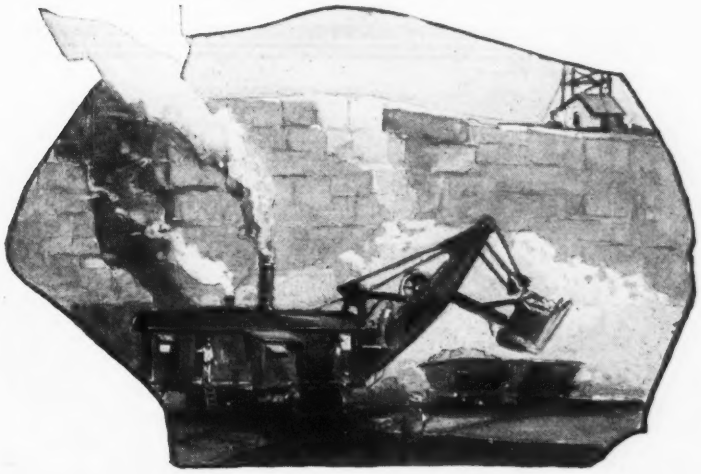

Has This Ever Happened In Your Own Quarry?

IN an Indiana quarry, recently, they made a shot with unwelcome results. After the dust cleared away, there stood the "toe"—untouched.

And that isn't all.

While the toe was being removed—all that extra work—two steam shovels were idle, their productive capacity crippled by a poor shot. What would the idleness of two shovels mean, in dollars and cents, in ***your*** quarry?

It pays to use explosives that invariably pull clean. The value of explosives like "Grasselli" is more fully appreciated when you realize what losses are ***avoided*** by a good clean shot.

Just what "Grasselli" will do under conditions in your own quarry is a matter our representative will gladly talk over with you—whenever you want him to call.

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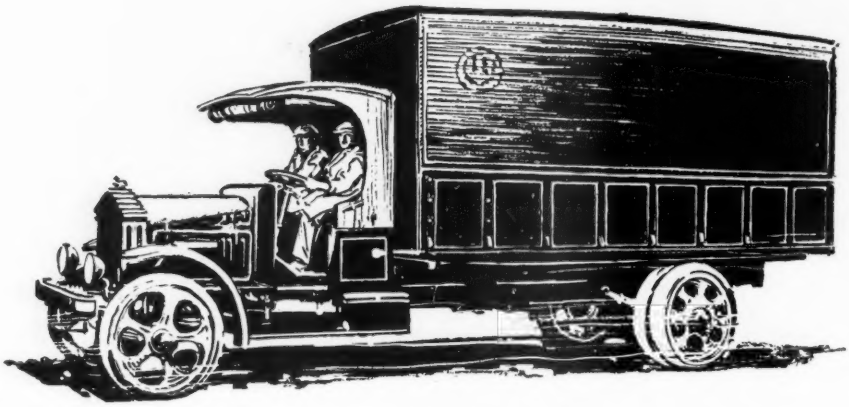

What is a high price?

A truck that outlasts other trucks and costs less to operate is not high priced. Cost must always be figured against the work done and the time that is saved. The first cost of a Pierce-Arrow is no more than any good truck costs.

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5 -ton 5700

All Prices F.O.B. Buffalo

THE PIERCE-ARROW MOTOR CAR COMPANY, BUFFALO, N. Y.

BROWNING
LOCOMOTIVE CRANES

Lime and Limestone

—are most easily handled with a Browning Crane. A Browning Crane and Bucket with a 50-ft. boom, can load or clean out the far end of a car while standing on the same track.

For maintaining a ground storage surplus or for reclaiming material from waste piles, the unit-handling-cost with a Browning is much below that of any other method.

Wherever handling costs must be kept at an absolute minimum the built-in-ruggedness and faithful performance of Browning Cranes makes a practical difference—measured in greater profits to the user.

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CLEVELAND, OHIO, U. S. A.

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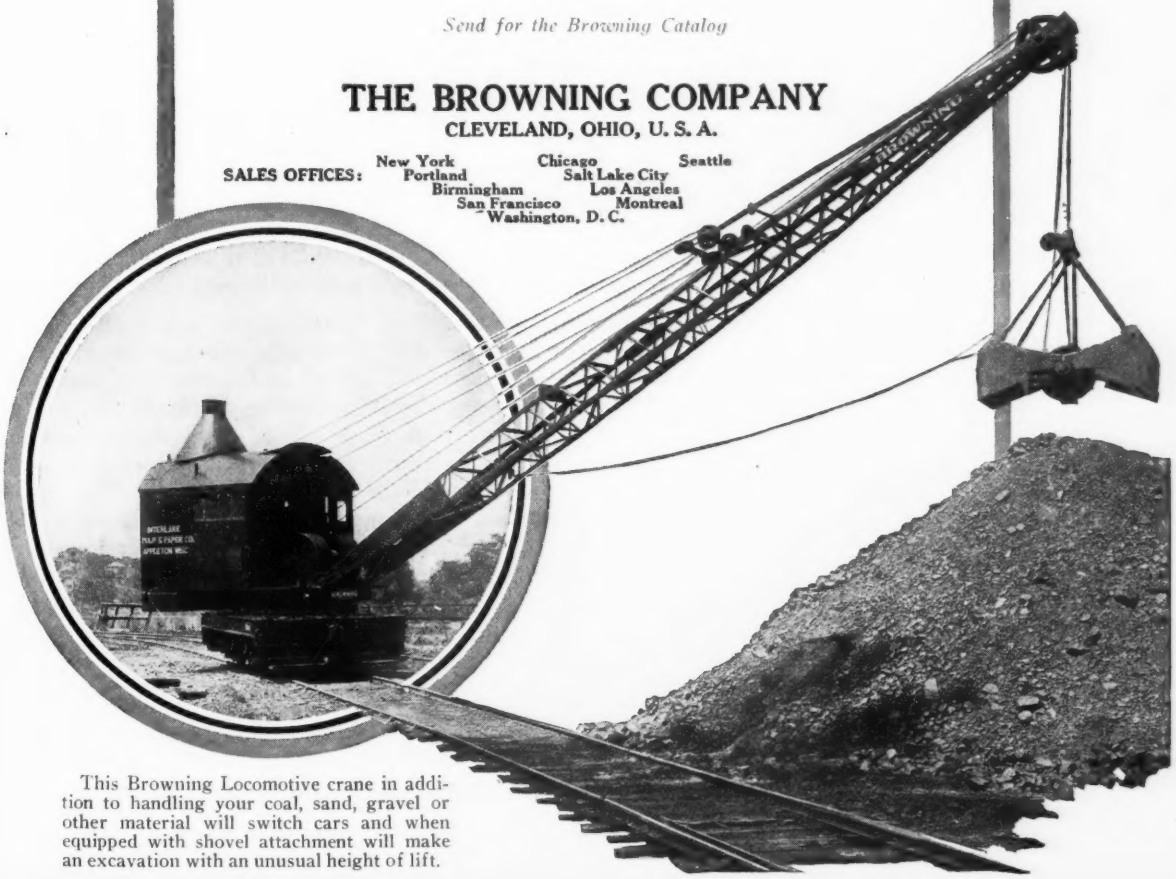
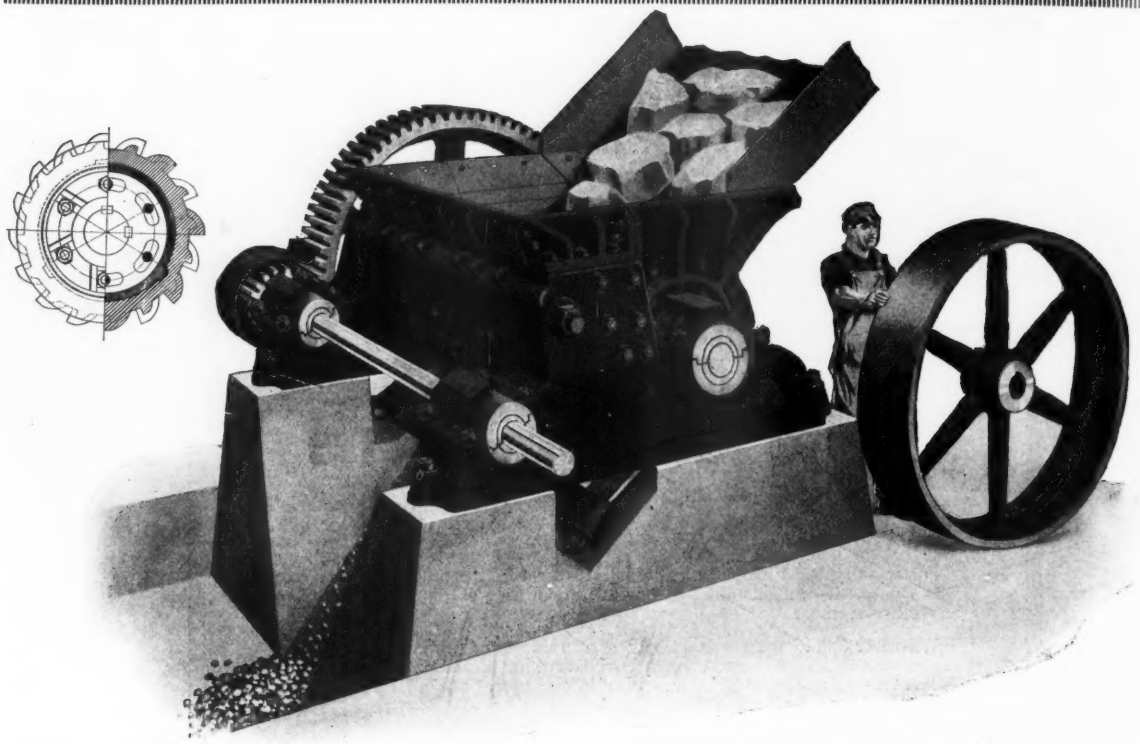


This Browning Locomotive crane in addition to handling your coal, sand, gravel or other material will switch cars and when equipped with shovel attachment will make an excavation with an unusual height of lift.



Stevenson New Type Crusher

This is a Single Roll Swinging Plate Crusher—our Model A-339—and while it is new in design, and an innovation in the crushing industry, it is old enough to have proven its efficiency, value and worth.

All wearing parts of this machine are made of the very hardest and toughest materials—manganese and other heat-treated steels. The teeth on the roll are transferable, thereby keeping up the efficiency and reducing the upkeep costs, and roll disks can be assembled to accommodate material being crushed, staggering the teeth or placing them all in a straight line. The breaking plate is provided with liners, half and quarter soles, of manganese or other heat-treated steels, and these can be changed on the breaking plate, thereby getting three different wearings from the same piece of metal. The bearings are big and strong, amply providing for any emergency. The gear teeth are short stub type of immense strength.

Stevenson Roll Crushers are self-feeding.

Write for catalog and complete information

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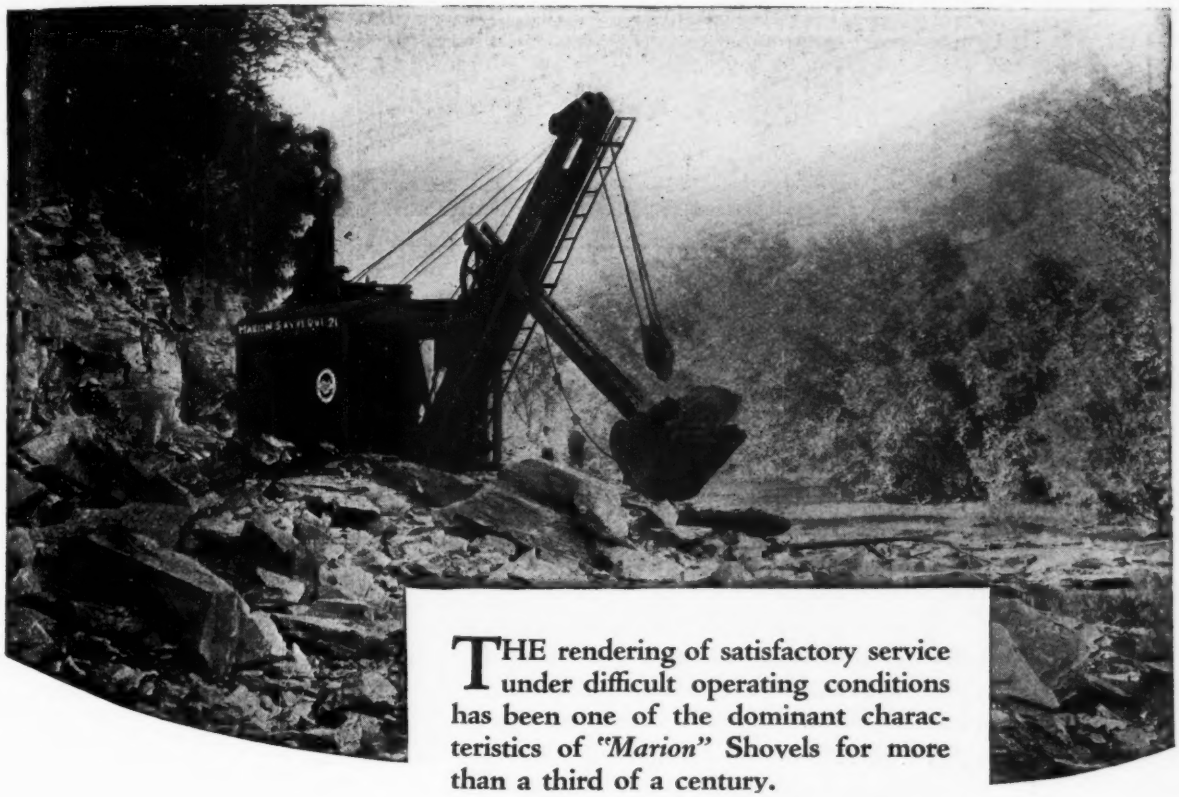

THE rendering of satisfactory service under difficult operating conditions has been one of the dominant characteristics of *"Marion"* Shovels for more than a third of a century.

Here we show a standard Model 21, building the grade for a railroad extension in Harlan County, Ky. A severe task, you'll agree, for a ¾ yard machine —for many of the boulders were large and heavy, others were of such shape they would not pass through the dipper, but the shovel handled them all at the rate of 400 cubic yards per shift and moved forward on an average of 150 feet a day.

Should *your* next job be of the *unusual* kind it will pay you to look into the merits of *"Marion"* shovels. Our general catalogue shows a complete line of excavating equipment. It's yours for the asking.

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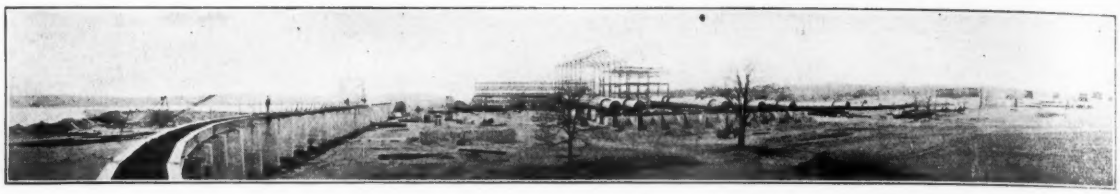
EVERYWHERE RELIABLE — THE Marion STEAM SHOVEL CO. — ESTABLISHED 1884



World's Largest Lime Plant is Vulcan Equipped

THE new potash plant of the Eastern Potash Corporation, near New Brunswick, N. J., is equipped with ten 8 x 125 ft. oil fired VULCAN KILNS.

In an industry where the possibilities are practically unlimited, the best possible equipment is naturally desired. The thorough knowledge of VULCAN engineers and the thoroughness of VULCAN workmanship inspires the confidence of those who desire the best.

VULCAN IRON WORKS

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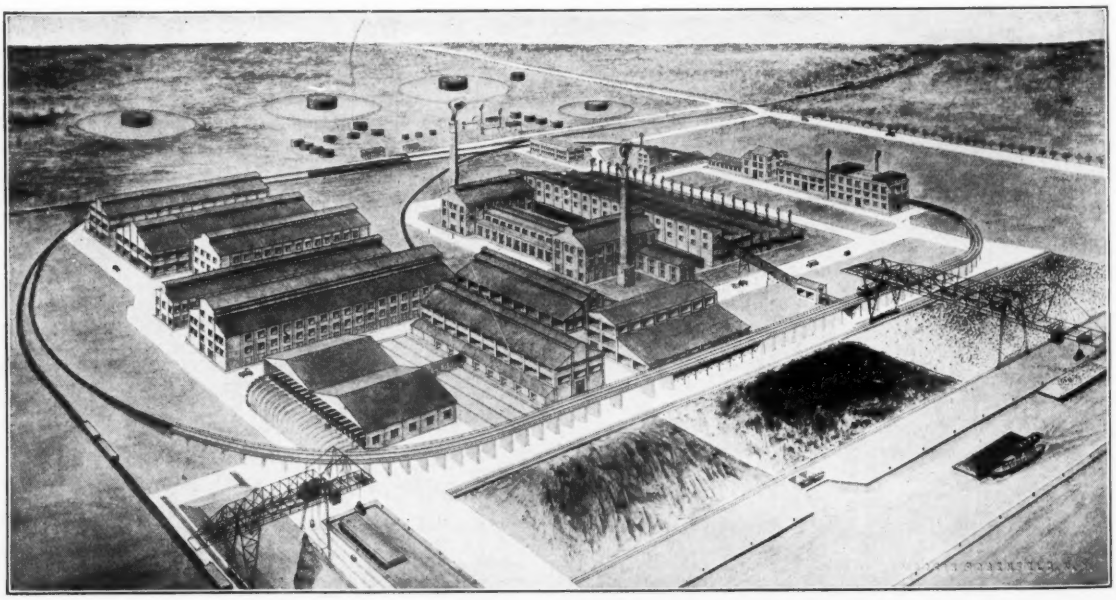
1753 Main Street Wilkes-Barre, Pa.



For your hurry-up handling job

When a handling job is started and must be finished by a certain time, any delay means a loss of time and money. This naturally places a big responsibility on the machine which is doing the work. And it means that you must have the right kind of a crane when your hurry-up handling job comes along.

Brownhoist locomotive cranes are built for durability and hard work. Hours after the plant is closed you may see Brownhoists hard at work in the yard. They are built for the hard service which experience has shown us most cranes receive. Unlike hand labor, they do not show the effects of overwork.

In some cases Brownhoist locomotive cranes have been on the job for over twenty years and are still giving good service. We shall be glad to send you a copy of our Catalog K which shows some of the old and new Brownhoists on different kinds of work.

The Brown Hoisting Machinery Company, Cleveland, Ohio
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Gasoline Locomotives

You can't make big profits without big production. If big production hinges on material transport, hitch a PLYMOUTH Locomotive to the load.

The PLYMOUTH Locomotive shown in the illustration is on its way to the kilns with a fourteen-car train, each car loaded to super-capacity.

Plymouth haulage means low first cost, easy operation and low upkeep.

The Fate-Root-Heath Co., Plymouth, Ohio, U.S.A.

Showing PLYMOUTH Gasoline Locomotive in the plan of Standard Lime Company, Joliette, Quebec, Canada

Rock Products

Vol. XXIV Chicago, June 4, 1921 No. 12

New York City's Aggregate Supply

Plentifully Supplied With Water-Front Quarries and Pits

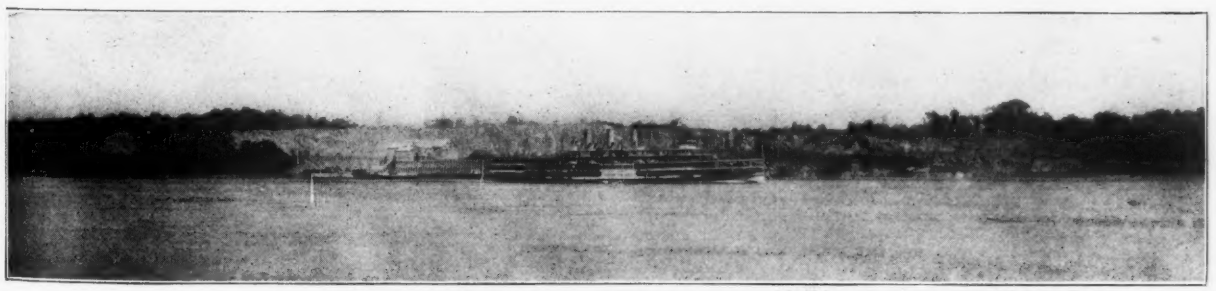
LONG ISLAND, across the East River from New York City, is practically all one huge deposit of sand and gravel. It is what is known technically as the terminal moraine of the great glacier that once swept over New England from the North.

Sand and gravel are mined all along the north shore of the Island, by both dry-land and dredging methods. The land plants are chiefly notable for the size of their outputs and their shipping facilities. All the material is moved to New York City on barges, towed usually in pairs. The voyage includes the passage of Hell Gate, where many a barge has come to grief.

Crushed stone for New York City also comes by barge from the Connecticut shore of Long Island Sound, near New Haven, and from the shores of the Hudson (North) River. The Connecticut quarry and one of those of the Hudson River quarries furnish trap rock, but the others furnish limestone. There are two large limestone quarries on each side of the river south from Poughkeepsie. These quarries have rail shipping facilities as well as barge lines, but most of the material moves by the water route.

Sand and gravel plant on the north shore of Long Island

Shipping facilities of a Long Island sand and gravel plant



A Hudson River limestone quarry from the opposite side of the river

"Dry Cleaning" Limestone Screenings

Cedar Cliff Limestone Quarry of the NewYork Trap Rock Co. Has Unique Method

IT IS FAIRLY COMMON PRACTICE to wash limestone screenings where the screenings are to be ground for agricultural limestone. Dry-cleaning by means of air separation is a rare operation in the limestone industry at present, but apparently it is practicable. But drying by rotary dryer and screening is nearly unique in the limestone industry.

The overburden at the Cedar Cliff limestone quarry of the New York Trap Rock Co., near Marlborough, N. Y., on west bank of the Hudson River, is very thin and is not generally removed. The screenings at this plant are ground for asphalt filler and have to be clean.

Therefore there was a choice of washing the screenings free from the top soil, and then drying and grinding them, or of drying, screening and grinding them without the washing operation. The latter process was decided upon and has apparently worked out satisfactorily.

The ledge is drilled with well drills but is loaded by hand. Small horse-drawn, flat-bottom quarry cars are used. The cars of stone are end-dumped into a No. 9 gyratory crusher.

From the initial crusher the stone goes through two 48-in. by 14-ft. rotary scalping screens, jacketed to remove 1½-in. stone. The screens have 3-in. holes.

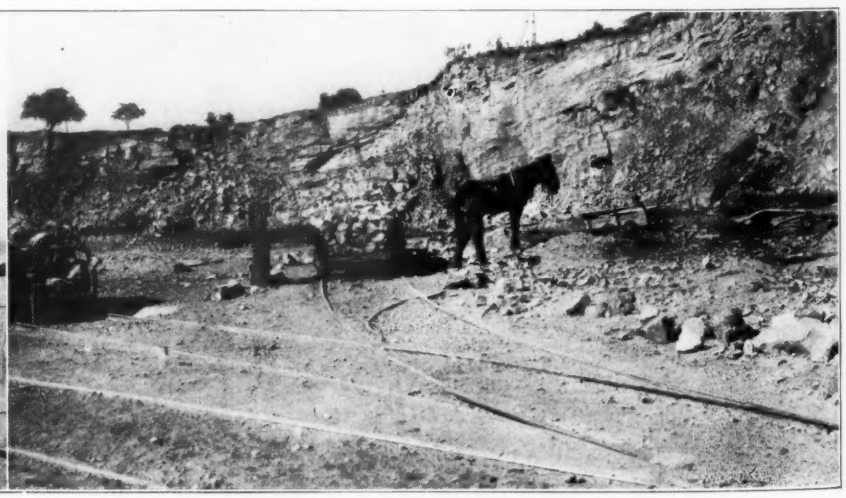
The screen rejections go to a battery of four No. 6 gyratory crushers. When there is no market for stone 1½ to 3-in. in size, the screen jacket rejections also go to the re-crushers.

Two elevators take the product of the four No. 6 crushers to three rotary sizing screens, two of which are 48-in. by 20-ft. and one is 48-in. by 12-ft. The two large screens take out stone between 1¼ and ¾-in. and the smaller screen takes out the ⅝-in. size.

The dust (or screenings) from all the screens is conveyed to a bin serving a rotary dryer. After passing the dryer the material is "dry-cleaned" in a screen 48 in. in diameter by 14 ft. long, jacketed to recover material from ⅜-in. to 7-mesh.

The clean limestone chips are returned

P. J. Gilcrist, superintendent



Quarry face showing type of quarry car used

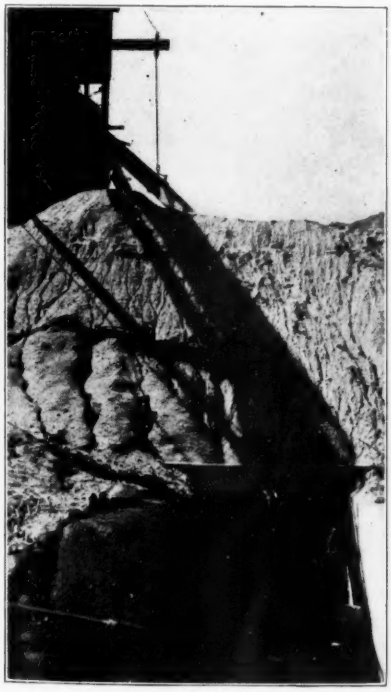
to the screening or grinding by screw conveyor, and are run into bins to be sold as clean limestone chips, or sent to the fine-grinding units to be reduced to 100-mesh dust or asphalt filler.

The fine dust from the screen, which of course is mostly clay or silt, is chuted to a waste pile over a sump. Water is pumped to this sump by a 10-h. p., electrically-driven centrifugal pump on the shore of the river. Two other dredge pumps, one 15-h. p. and the other 25-h. p., take out the mixture of silt and water and pump it a distance of several hundred feet (3,500) up the river bank where it is wasted in a mud flat.

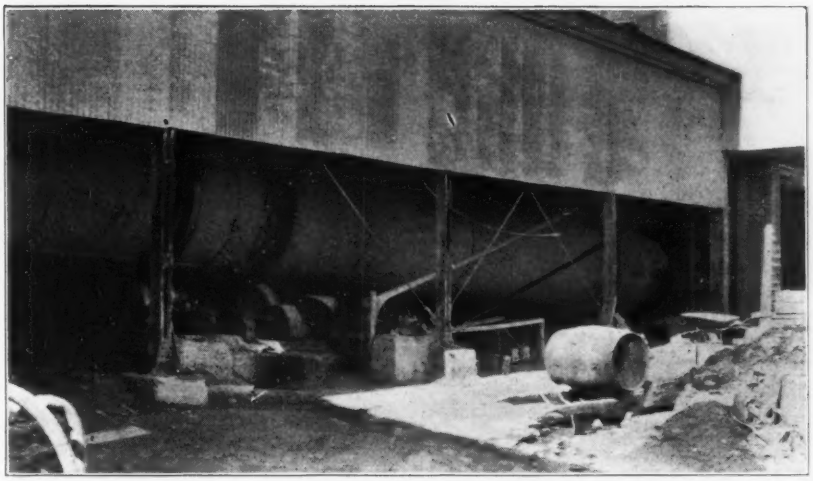
Thus it will be seen that, in the last analysis, this is a hydraulic stripping operation—in which the stripping is screened out, but nevertheless taken care of by hydraulic methods.

This plant produces about 1,000 cu. yds. of crushed stone a day. The superintendent in P. J. Gilcrist and the vice-president of the New York Trap Rock Co. in charge of operation is James M. Shaw.

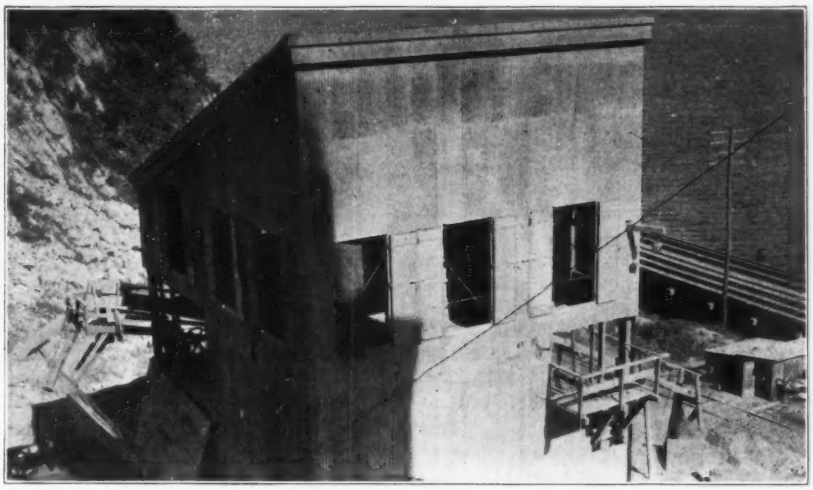
Dry dust from dryer falling on waste pile over sump



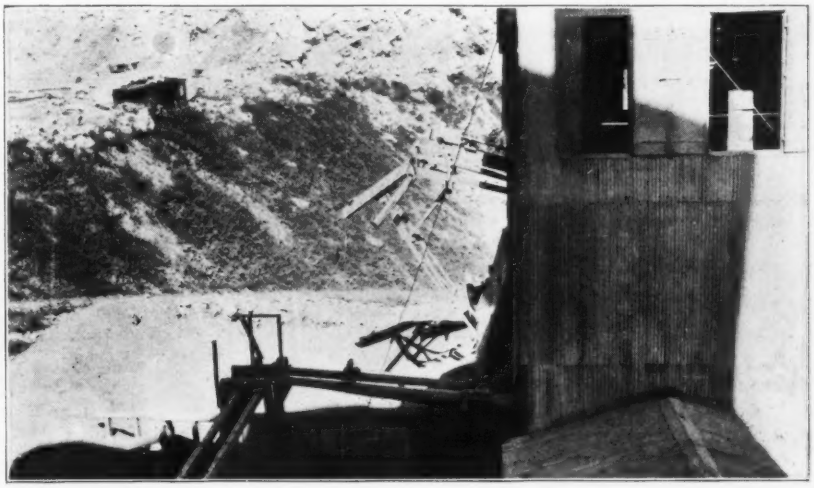
Waste pile of dust (silt) showing pipe for water



Rotary dryer for drying screenings preliminary to screening



Dust screening house—pump house on the extreme lower right



Clean limestone chips returning to stone plant by belt conveyor and screw conveyor

Exploration of Limestone Deposits

Notes on the Lime Industry by a Mining Geologist

By Joel H. Watkins
Mining Geologist, Washington, D. C.

UNTIL quite recent years, limestone has been considered, in a general way, to be a very plentiful material. This has been more or less true, but as time goes on and the demand for pure limestone increases from year to year, the supply of high grade stone is no longer referred to in broad terms, as being inexhaustible. Those who are in daily touch with the production of lime and limestone, and those who have made a study of the limestone resources of the country, are beginning to realize this condition, and its influence upon the future of the industry.

Where Limestones Occur

The actual geological conditions under which limestones occur, at or near the surface, have a great deal to do with the supply available under economic methods of quarrying or mining. These conditions also govern to a large extent, the possibilities of gaining possession of such limited surface areas as may, for a period of time at least, keep out competition. For example, a series of limestone beds, laid down in chronological sequence, and aggregating a thickness of 40 feet, may be flat-lying with little or no over-burden, as in Northern Ohio, Eastern Wisconsin, and Southwest Missouri; they may be flat-lying or with slight dips but covered with a heavy mantle and only exposed along valley escarpments, as in Eastern Missouri, Western Pennsylvania, and Northern Alabama; or they may be steeply folded with the crests of the folds eroded away, thus only exposing the edges of the upturned beds with dips of 40 degrees or more from the horizontal, as in Central Pennsylvania, Western Virginia, and Eastern Tennessee. In the first case, where the beds are flat-lying with little over-burden, large areas underlain with a workable thickness of limestone, are still available at the prevailing price of farm land. In the second case, where the beds are flat-lying but only exposed along escarpments where the over-burden has been eroded away, the matter of nearness to railroad transportation generally enhances the value of desirable locations. In the third case where workable beds are only exposed at intervals, and along narrow strips of country, but few desirable locations remain to be exploited, which are not remote from the railroads. This last example is especially the case in the Appalachian states.

In some parts of the country, far-sighted men have anticipated the growth of the lime burning industry, and have gradually acquired extensive and valuable limestone deposits. In a few cases, these holdings virtually give control of certain markets.

Lime Industry Old

The burning of lime is a very old industry, having been practiced by the Romans, and described by Pliny as early as A. D. 77. In this country, the early kilns were all of the "field" type, or of the "pot kiln" type. They were more or less rudely constructed of stone, and not always lined with fire brick. The plants were small and often located without due regard to the quality of the stone to be burned. In the past, much of the agricultural lime has been burned by farmers, in small field kilns, where they were so fortunate as to have limestone exposures on their own properties. This practice, however, is rapidly passing out.

In the past few years, I have had occasion to make geological and economic reports on the limestone resources of five of the large lime manufacturers, besides making observations on the plants and quarries of a number of other companies. It is my desire in this discussion to set forth briefly some of my observations in regard to the needs of the lime industry in general, as I see them at this time. I believe that these observations would make a like impression on any geological or mining engineer who would cover the same ground.

Possibilities for Engineering Control

The elementary principles of burning lime, by applying heat to the raw stone through updraft kilns, are simple. This may have had something to do with the tardiness with which some of our best lime companies have taken into consideration, the possibilities of engineering control. Broadly speaking, I do not know of any industry that, at this time, offers greater opportunities to chemical, mechanical, mining and geological engineers, than the lime industry. It is true that some very long strides have been made by the technical branch of the industry in recent years, and that even now the processes of burning, hydrating and mechanical handling of lime, are in a state of evolution. As may be expected, however, these experiments are expensive, and there have been some failures.

Unfortunately, many of the older companies, who seem to have made money in spite of their methods of operation, have been reluctant to share their part of the expense in working out more efficient and more economic methods of producing lime. That is to say, in many cases, they have waited for their competitors to try out the new order of things. If the experiment is unsuccessful, they will probably say, "I told you so." But if on the other hand, the experiment is marked with a degree of success, instead of taking steps to avail themselves of whatever benefits may be derived from new processes, they will look backward to the good old days when labor was reasonable and competition slight and say, "that was good enough for me." I do not consider this attitude, however, to be altogether the fault of the individual manufacturer.

Drawbacks in Lime Industry

Many of the producers may have the progressive spirit, but are not financially strong. In my opinion, some of the great drawbacks are, that there are too many small plants, too much waste, too much disseminated energy, too many power plants, too many organizations, and too few engineers. If some of these lime companies could cash in the money they have buried in their quarry dumps they could almost afford to retire from business. We know, of course, that quarry dumps are necessary, and that this money has been distributed over the entire period of operation. The questions which an engineer would inevitably want to investigate in this case are—could not a large amount of this waste have been avoided, and, would it not have cost much less to have stripped a large area at one time?

One thing that many industrial managers do not seem to understand is that an appropriation of say, $200,000, if spent at the rate of $50,000 per year, will not always accomplish the desired result, whereas the same amount of money, judiciously spent at one time, may often increase the efficiency of operations beyond calculations. How many lime plants can you remember seeing which appear to have been built on the installment plan. At one end of the row will be an old stone kiln, probably built some 30 or 40 years ago. To this has been added a shed and a stack or two at a time, until the present outlay looks like a miscellaneous collection of kilns.

Examples of Quarry Operation

At one plant that I visited, the stone is loaded in wagons at the quarry and hauled with teams a distance of two miles to the plant, which is located at the nearest railroad station. This plant has apparently been in successful operation for years, but how can you believe it? At another plant, stone is now, and has long been, quarried at one point, trammed one-fourth of a mile, loaded into gondola railroad cars, hauled one and a half miles to plant, unloaded, partly on the ground, re-loaded into quarry cars, and finally hoisted to the kilns. At another very modern plant, it takes three and sometimes four hoisting engines, with the aid of from eight to ten men, to take one car of stone from the quarry to the kilns, where one hoisting engine and four men could do the work as well, and at one-third the cost. At still another point, one company is normally operating against 18 quarry faces within four and a half miles, along a narrow belt of high-grade stone. These quarries, to supply eight groups of kilns, require 14 quarry bosses, 12 dinkey engines, 10 inclines and no end of overhead. The same amount of stone, averaging from 800 to 1,000 tons per day, can be readily taken out of one shaft by underground mining methods. It may be of interest to say here, that in the last-mentioned instance, developments are already well under way toward taking all stone from one deep shaft, and burning all lime in one group of modern kilns, within 300 feet of the shaft.

Though marked improvements may be made in many of the old plants, it is needless to say that a plant of small capacity will never be able to produce lime as economically as a plant of large capacity and of modern design. This should be as true of the lime industry as of the cement industry.

Concentration of Power Needed

As stated above, to my mind, the great need of the lime industry today is a combination of financial interests which could afford a concentration of power, energy, research, engineering control, and personal initiative. This should also involve central selling agencies, and the elimination of many small plants. It takes real money to do the job right, and it is generally the initial cost that frightens the small producer.

Need for Engineers

In most cases, quarry operations are planned and carried out by quarry bosses, under the supervision of plant superintendents. When the over-burden has become heavy, and the dead work excessive, it has often been an easy matter to move a little further from the plant and open a new quarry. The possibilities of nibbling off the stone at points of shallow over-burden are, in many cases, becoming less attractive, and such practice, in the long run, is often expensive. At this point the lime producer is badly in need of the advice of a mining engineer. It is as easy, and often much easier, to go underground for limestone as it is to mine other mineral substances. In any case, the thing that is of infinite importance is to obtain the services of an engineer who has had thorough training in mines of large and continuous production at lowest cost. The matter of successfully taking stone from underground is strictly the business of a mining engineer, and you can never make a mining engineer of a quarry boss no matter how long he has been with the company.

As a basis for future extensions and developments, a careful geological and economic survey of all limestone resources is very necessary. To accompany such reports, complete geological maps and sections should be prepared, showing the area underlain with workable stone, the thickness of the stone, the approximate amount and character of over-burden, and the advantages of quarrying versus mining. Such maps and sections also afford a ready and accurate basis for estimating the reserve of stone available under different conditions, the amount of annual depletion, and the amount of stone which should properly be considered for purposes of determining the period of amortization. Carefully prepared maps of this kind will also be found to be indispensable as a basis of valuation in the case of sale, or of reorganization.

Lime Industry in Infancy

In conclusion, I will say that I believe the lime manufacturing industry in this country to be only in its infancy, and that those now engaged in the production of lime do not fully realize the possibilities of increased production. The industry as a whole can afford chemical research and engineering efficiency of the best the country can supply; it can afford to go the limit with intelligent and diligent publicity, and in some localities it can afford reorganization and re-financing.

The many men in the lime industry whom I have the pleasure of knowing, show a fine spirit and are inclined to be forward-looking. They are not, however, always magnanimous, and are sometimes reluctant to give up their long-established operating practices. They have no doubt seen some experiments fail, and may have at some time received poor advice from so-called engineers. The personal equation does after all enter as largely into the business of manufacturing lime, as it does into other industries.

Largest Output of Gypsum Products in 1920

IN 1920, for the first time in the history of the industry, the quantity of gypsum mined in the United States in any one year exceeded 3,000,000 tons. The total quantity mined was 3,129,142 short tons, as compared with 2,420,163 tons in 1919, and the total value of crude and calcined gypsum sold as $24,533,065, an increase of nearly $9,000,000 over sales in 1919. The figures indicate that the industry had a prosperous year. All the principal gypsum producing states increased their production, and the quantity of gypsum sold for each of the common uses was larger than in the preceding year. The demand for agricultural gypsum was so great that the sales rose from about 40,000 tons in 1919 to 107,443 tons in 1920. The other notable increase was in the sale of gypsum boards and blocks. The quantity of this material sold was 308,756 tons, valued at $6,091,617, as compared with about 180,000 tons, valued at about $2,300,000 in 1919.

Gypsum was mined in 18 states and in Alaska. More than half the gypsum sold in 1920 was mined in four of these states —New York, Michigan, Ohio and Virginia—the only producing states east of the Mississippi.

The imports of the gypsum increased in 1920, but are not yet so large as before the war. The imports of crude and calcined gypsum in 1920 amounted to 297,407 short tons, as compared with 451,925 tons in 1913.

The above data was compiled by the United States Geological Survey.

GYPSUM PRODUCED AND SOLD IN THE UNITED STATES IN 1920

	Quantity Short Tons	Value
Sold without calcining:		
For Portland cement	541,901	$ 1,941,057
As agricultural gypsum	107,443	557,925
For other purposes	19,916	66,213
	669,260	$ 2,565,195
Sold calcined:		
As wall plaster, Keene's cement, plaster of Paris, etc.	1,578,360	$15,723,372
For dental plaster	1,731	27,440
For glass factories	15,637	125,441
As boards, blocks and tile	308,756	6,091,617
	1,904,484	$21,967,870

GYPSUM SOLD IN THE UNITED STATES IN 1920, BY STATES

State	Total Quantity Mined Short Tons	Total Value of Products
Iowa	571,895	$ 4,422,965
Kansas	130,044	968,298
Michigan	382,212	3,521,028
Nevada	143,929	1,100,261
New York	780,295	6,438,929
Ohio	277,899	2,161,038
Oklahoma	135,279	816,768
Texas	220,157	1,439,491
Wyoming	57,732	410,724
Other states	429,700	3,253,563
	3,129,142	$24,533,065

Fonda Lime Works, Vermont

A New Manager With No Experience in the Lime Business Overcomes Difficulties Without Knowing the Prejudices of Some of the Old Timers

WHEN the original proprietor of the Fonda Lime Works, St. Albans, Vt., died, his brother, who has many other interests which require his time, selected a young business man as partner and manager of the lime works. This man had had no previous experience in the lime business, but he succeeded in making lime just the same. Because he did not know of some of the theories and prejudices of more experienced lime manufacturers maybe he discovered some things of value to the lime industry in a practical way.

The Fonda lime plant consists of five wood-burning shaft kilns with the wide-flaring fire boxes which seem to be characteristic of New England. These fire boxes, of which there are two to each kiln, open out on the inside to about one-half of the full inside diameter of the kiln.

The kilns are the ordinary steel shells, firebrick lined. The top diameter is about 6 ft. and diameter at the fire boxes about 7 ft. From the fire arch to the top of the kiln is about 24 ft. The kiln lining over the fire arches, which as noted, span nearly a full half diameter of the kiln, are supported by three brick piers.

Each kiln has a capacity for about eight tons of lime per day and burns four to five cords of wood. Wood is getting scarce and it is now customary to burn about 40 per cent of coal in place of the equivalent amount of cord wood.

Quarry Operation

The limestone is a hard, close-grained, marble-like high calcium stone. It is quarried in a bowl-shaped quarry by hand methods and the cars are hauled up a power-operated incline and roll by gravity to the plant.

Drilling is done by compressed air drills, the steam-driven air compressor being located in the quarry, as one of the views herewith show.

The empty cars are hauled back from the lime plant to the quarry by horses.

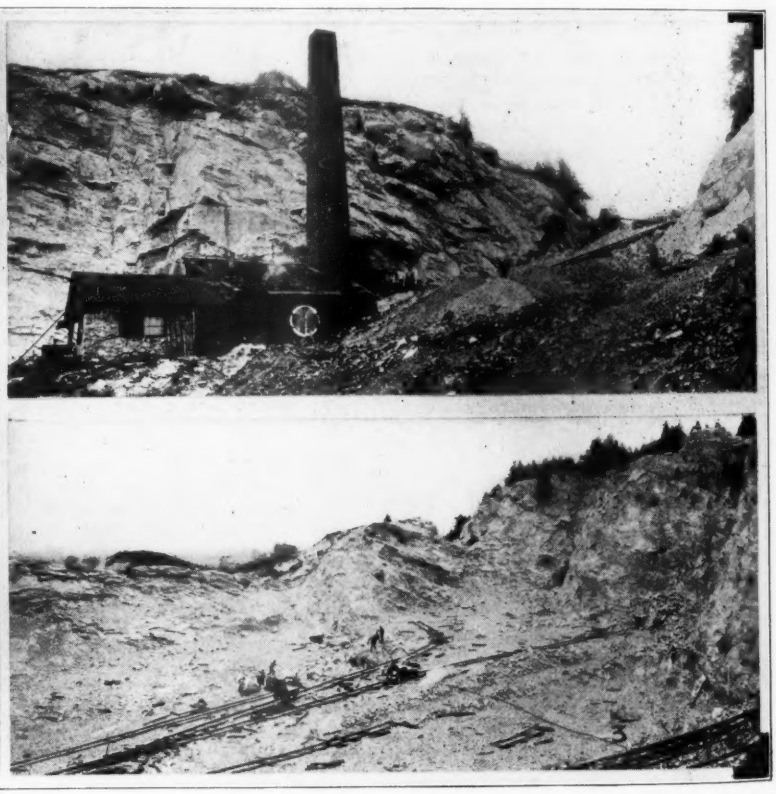
Operation of the Kilns

It was found in burning 40 per cent of coal with the wood that forced draft was necessary, and this was supplied by a small blower driven by a gasoline engine. A good grade of partially-screened gas coal is used.

Soon after the new manager took over the plant wood became so scarce that it was necessary to operate the kilns entirely with coal fuel. It was soon discovered that an all-coal fuel with forced draft burned the linings out of the kilns in no time at all, and produced an over-burned lime as well.

In searching about for a means of producing a fire similar to a wood fire, the new manager belted a small centrifugal pump to his gasoline engine and piped the water to each fire box, where it was applied to the fire in the form of a fine spray *continuously*. Other lime plants have tried this method of tempering the fire at intervals, but it is believed this is the first instance of a spray of water be-

L. F. Wilson, Manager of the Fonda Lime Works



Above, compressor house at edge of quarry; below, quarry view showing incline at extreme lower right-hand corner

ing used continuously on the furnace fires.

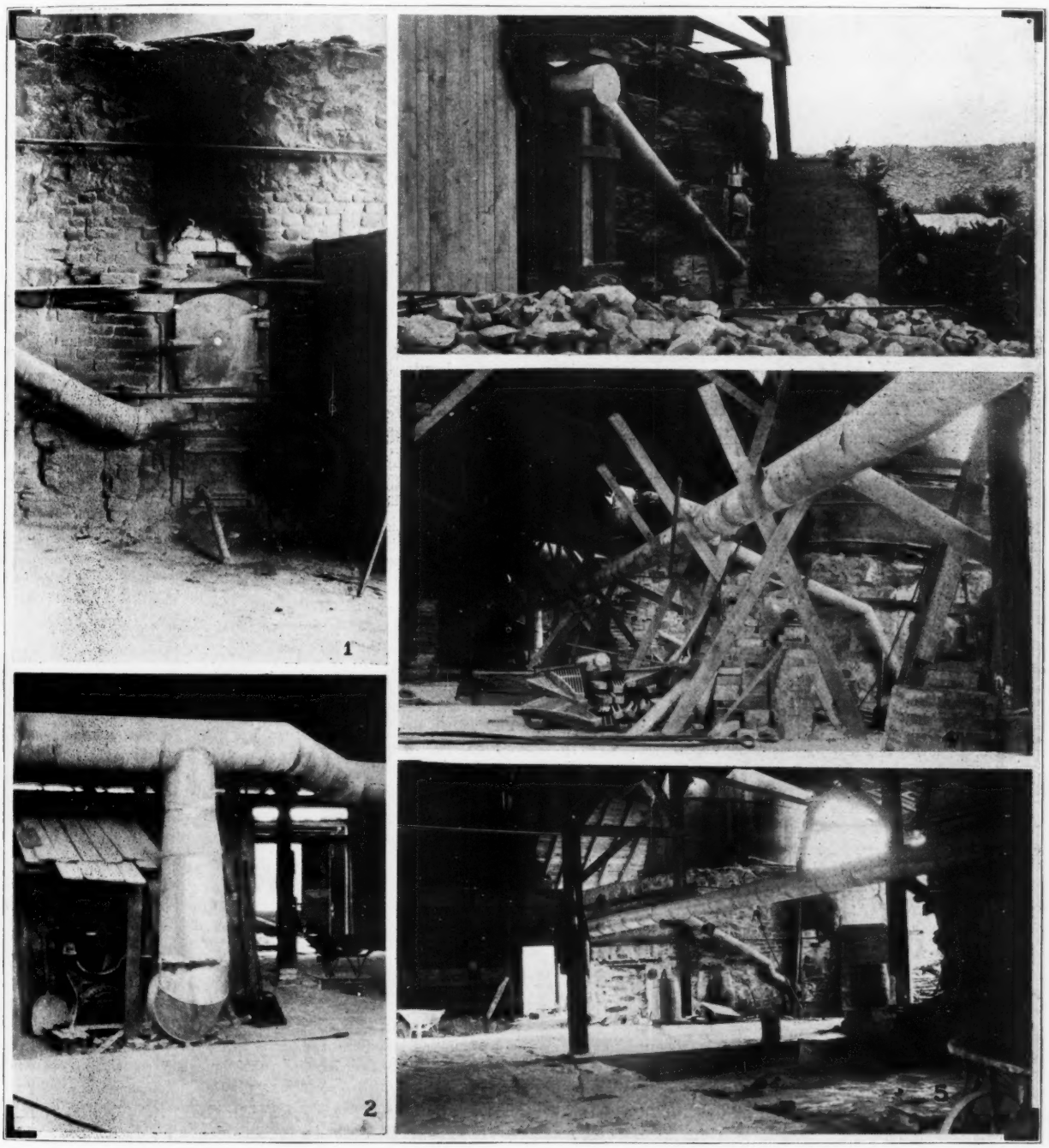
The ordinary method of operating the kilns was to leave the furnace doors open with the spray of water playing continuously over the bed of hot coals. The forced draft was of course also used.

It was found that this very nearly approximated the results obtained with *green* fire wood and forced draft, which was the best combination of conditions for the manufacture of a high-grade chemical lime. About the only difference was in the effect on the linings of the kilns, which could not be made to last as long with coal as when burning wood.

The kilns are drawn every 12 hours by the "sticking" method. They are operated seven days a week. The kiln tenders are paid on the piecework system, so much per barrel of lime made.

The views shown herewith were taken last fall, soon after a severe fire had put the plant out of commission, and only temporary repairs had been made. The fire was another of the many difficulties the new manager had to contend with, but he had the plant in operating condition within about one month's time after the fire.

The Fonda Lime Works is a partnership of F. W. Fonda and L. F. Wilson, who is the new manager referred to in the foregoing description.



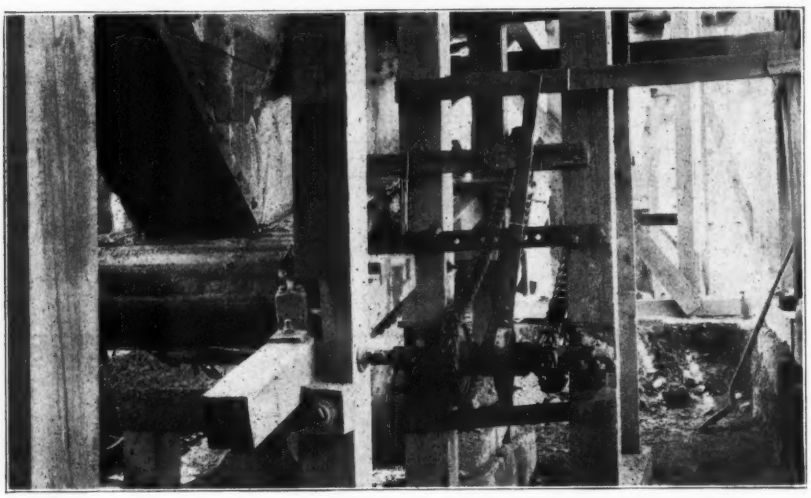
1—Furnace of lime kiln; 2—Gasoline engine driven blower for forced draft; 3—End kiln showing method of connecting draft; 4—Air pipe temporarily in place after fire which practically destroyed original plant; 5—Interior view showing other end kiln

Hints for Superintendents

A Two-Speed Feeder Apron

THE ACCOMPANYING ILLUSTRATION shows a two-speed device for a feeder apron for feeding sand and gravel from a hopper to a belt conveyor. The feeder is driven from the conveyor pulley.

The fast speed is 27 ft. per min. and the slow speed is 19 ft. per min. By means of this arrangement very dirty material may be delivered to the belt on slow speed, thus insuring a thorough washing in the plant. The change of speed is effected in a moment without stopping the operation of the plant.



Two-speed feeder apron

This device is in use at the Interstate Sand and Gravel Co.'s plant at Libertyville, Ill., described in ROCK PRODUCTS, May 7, last. Burton H. Atwood is the president of the company and Chas. A. Adams is the plant superintendent.

How to Steer a Traction Wheel Shovel

IN MOVING A TRACTION WHEEL SHOVEL equipped only with hand steering device from one job to another over pavement the hand steering device is often inconvenient and slow. A. M. Owen, a well-known shovel operator of Dixon, Ill., gives us the following method of steering a shovel of this type. This method of steering is of course not recommended for use on shovels equipped with power steer, as it produces side strains on the dipper and boom.

Drop the dipper as close to the front truck as possible, midway between the wheels. Attach a ¾-in. chain to the axle just inside the wheel, by putting a ¾-in. bolt through the links with a washer on either side. Run this chain through the dipper braces making it fast to one of these by looping the chain around it. Then attach the chain to the other side of the axle just inside the wheel.

Loosen the chain from the hand steering device so that the wheels can be turned freely in either direction. Then raise up with the boom engine till the chain is tight and put a 1¼-in. nut in the racking on the dipper stick to hold the dipper stick in this position Then pull up with the hoisting engine till the hoisting cable is tight. This must be done carefully.

Now use the swing engine for steering. The front axle turns as the dipper moves to one side or the other.

This steering device can be put on or taken off in three minutes, and of course is much better than putting the dipper out to one side and skidding the machine to the position wanted, as is often done. —"The Excavating Engineer."

Reclaiming Hollow Drill Steel

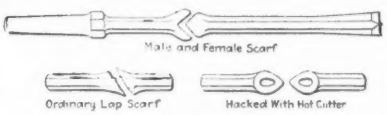
IN QUARRY operations where jackhamers and water-line drilling machines are used largely, many pieces of hollow drill steel become broken owing to the hard use to which they are put. Considerable loss is involved unless some proper method of reclaiming this steel is devised. Hollow drill steels should first be collected and classified, so that in reclaiming the original lengths can be kept.

It is essential to pay proper attention to the arrangement of the forge fires and the use of high-grade smithing coal. Slaked coal having no lump larger than that which will pass through ½-in. mesh should be used.

In building the forge fire dampen the coal and thoroughly mix it until it is in a plastic condition. Then place a block of wood 4x4x15 in. on the draft opening, and fill up around the block thoroughly and pack the coal with a sledge. Remove the block and fill up the hole with live coals, oily waste, or any dry material which will ignite readily. When the fire is well started, put on some coke, allowing the fire to get hot before welding operations proceed. The idea in this is to confine the fire to a very small area so that the welding operations can proceed with ease.

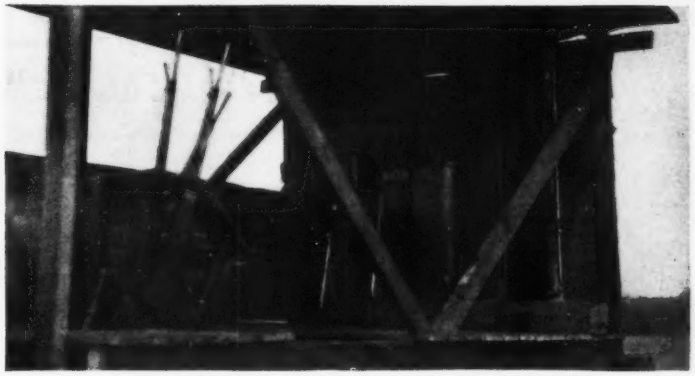
The plane of the anvil should be that of the forge. On the side of the anvil opposite the forge place some sort of rigid frame upon which the drill steel can rest and against which they may be thrust when the welding operations begin. If the male-and-female-scarf method is used, the pieces of scarf steel are driven together in the fire, then withdrawn on the anvil. Careful attention to the scarfing details should be made regardless of the methods used.

In diagonal scarf welding the broken



ends should be heated to a forging heat a distance of approximately 3 in. from the break and where the weld is to be. After heating, drift holes with a long tapered drift pin. Then with a sharp, hot cutter cut the steel diagonally to form the scarf. Drift out the hole again and pack the scarf with the hot cutter. Place the steel in the fire, scarf side up. Take a slow heat, applying a little welding compound. When at the proper welding temperature, bring out the steel and make the weld on the anvil. After the weld has been made, the holes can be cleared out of all scales with a small wire. Place the steel in a dry place and allow it to cool. Care must be exercised in both heating and cooling as only in that manner can forging strains be removed and the drill steel be insured against breaking at or near the weld.—J. C. Lamon, Calderwood, Tenn., in "Engineering News-Record."

Hoist house

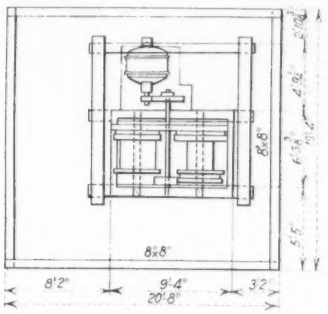


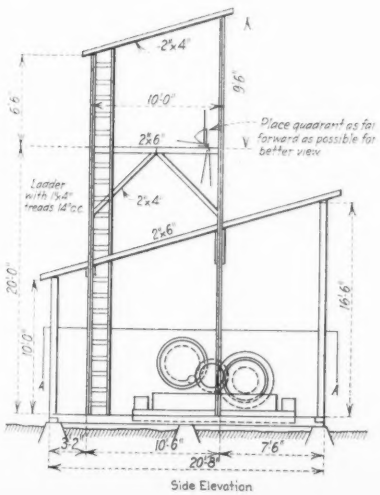
Top of hoist tower showing operating levers

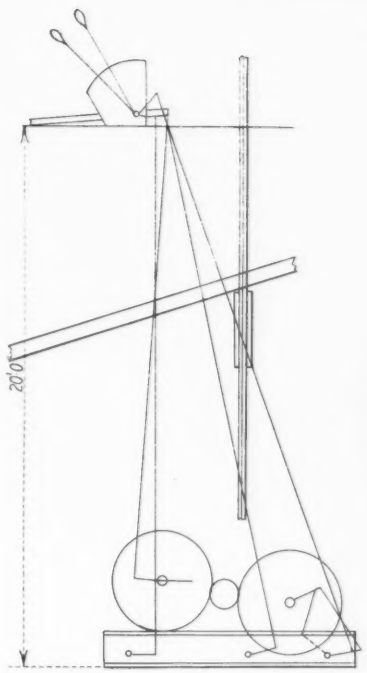
Tower for Hoist House

A FREQUENT CAUSE of inefficient operation of a dragline excavator may be attributed to the fact that the operator is usually placed in some position where he cannot get a complete view of the operations. In order to operate the dragline efficiently and avoid breakage the operator should be placed in a position where he can get a complete view of all that is being done from the point where he digs the material until he dumps it into the receiving hopper at the plant.

To obtain this result the Premier Sand & Gravel Co., Jackson's Lake, Ala., constructed the tower above the hoist house that is illustrated in the accompanying photographs and drawings. The tower is 20 ft. above the ground and affords the operator a complete view of the work he is doing. The controller for the hoist motor and operating levers for the hoist are located in the tower. The atttachments from the operating levers to the hoist proper were made of 1-in. pipe connections. On the roof of the hoist house is a trap door, which on being opened, affords the operator in the tower a view of the drums on his hoist.







The man in the tower not only gets a better view of his dragline operation but the conditions for working are more satisfactory. Instead of being cooped up in a dark and close place he works in a light and roomy tower, which is an additional aid in obtaining increased efficiency in the dragline operation. W. A. Winston is superintendent at this plant.

Chute Lining

AN EXAMPLE of the use of crushed stone for lining chutes at a crushing plant was given in ROCK PRODUCTS, May 21, 1921, page 31. Herewith, is possibly a slight improvement in this method of lining chutes found at the plant of the River Rock Gravel Co., Tracy, Cal.

The chute is lined with 30-lb. rails, heads up, laid so that the flanges touch. The spaces between the webs and heads of the rails soon fill up with gravel, which takes most of the wear. In any event the heavy rail heads are bound to last about as long as the plant. This method of chute lining also provides a good use for old rails. Carl Noldeke is superintendent and William H. Ford is president.

Chute lining, showing heads of rails and crushed stone between

Sand and Gravel Production

Survey of 22 States*

Government Collected Data Shows Occurrence of Road Materials in the United States

By Geo. E. Ladd
Economic Geologist, U. S. Bureau of Public Roads

IN SPITE OF THE FACT that the United States has under way a vast road-building program, except in very few states no systematic survey of road materials has been undertaken. The United States Bureau of Public Roads has records of thousands of tests of road materials, and state highway organizations have similar records, for their own territories, respectively, but field information is lacking. Testing records are worthless in themselves unless it is known that the sample collected represents an average of a workable deposit. The information needed is much broader in scope. The highway engineer must know where material is available, the nature of the occurrence, extent, thickness, accessibility, transportation facilities, conditions affecting production—in short availability for roads, and the necessary costs involved in getting the material, in desired form and condition, to the roads.

The Dominion of Canada has long conducted systematic surveys of its road materials. A few of our own states are compiling and publishing information on this subject, but very little indeed has been done in the way of systematic surveys undertaken and conducted with the needs of the highway engineer in mind. The Bureau of Public Roads has carried on economic studies of rock excavation and the production of broken stone. It has compiled lists of broken stone, and sand and gravel producers in the United States, and has assembled all available information on the occurrence of road materials from publications and records of geological surveys, university geological departments, mining bureaus and state highway commissions.

Survey of 536 Plants

During the field season of 1920, because of problems arising in the administration of the Federal Aid Road Act, a survey of producing sand and gravel plants in the United States was begun and work was completed in 22 states. During the progress of this work, as much general information as possible was obtained, collaterally, about the distribution and quality of sand and gravel deposits in the area covered; and so far as possible our list of broken stone producers was revised. A detailed study was made of the sand and gravel industry as a source of road materials. Approximately 1,000 pits and plants were visited in the area under consideration.

The tabulated information which follows pertains to 536 plants, at which 13 different methods of excavation were noted.

These tables do not include data on molding, glass or other special sands, crushed sandstone, or hand excavating plants at sand and gravel pits, unless the latter have a capacity of at least 300 tons per day. It should be borne in mind, therefore, that table No. 2, totals the production figures only of the plants under consideration in this paper. Many states possess widespread gravel deposits of excellent quality which occur so generally, and from which material is so readily obtained for local use, that permanent-type plants are few in number or entirely absent. This is noticeable especially in the New England States, where the scarcity of sand and gravel plants of the types included in the tables below is not the result of the absence of sand and gravel deposits, but, on the contrary, because they may be found wherever need occurs.

Lest the terms "wet" and "dry" as used in the following tables be misunderstood, the reader's attention is called to the fact that these terms are used in reference to excavating conditions only, and not to screening methods. As a matter of fact very few plants listed are dry plants in the latter sense.

When the survey was started car shortage was acute, and information on that subject was gathered. Although there has been a complete reversal of that condition within the past few months, results of car shortage as they affected this industry are indicated in Table No. 2.

Information obtained by field men on this survey was embraced in a questionnaire and instructions which covered the following points: Name and address of the operator; location of plant; transportation facilities; geological occurrence of the deposit; amount of stripping; thickness of deposit where obtainable; thickness worked; kind and character of material; notes on percentage of sizes; variations throughout the bed; mechanical analysis of the commercial product; uses of the products; sand and gravel production for 1919 and 1920; tonnage sold for road purposes; daily capacity of plants; length of operating season; effect of car shortage on production; sketch of plant arrangement; description of plant and method of operation, with flow sheet; kind and amount of power used; details of screening operation; storage arrangements; labor employed at each unit of operation.

Many photographs were taken and samples of sand products were collected and sent to the bureau laboratory for mechanical analysis and microscopic examination.

Few Commercial Plants in New England

In the New England States, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island, glacial gravel and sand beds are widespread. They are mostly worked in original deposits, but stream gravels are used, particularly in Vermont, where so many roads are built in the narrow valleys of the Green Mountains.

Clamshell dredges operate from Boston for sea sand, and dredging boats sometimes operate from points in Maine. For a generation past great quantities of sharply angular quartz sand have been taken from the harbor at Newburyport, Mass., at the mouth of the Merrimac River. Throughout New England local pits are worked for road material as needed, and all the cities and towns of consequence have sand and gravel beds within or near them, from which material is hand-excavated and used as "bank run," or as dry-screened sand and gravel. The total output from such pits is large.

In Maine and New Hampshire, mechanical-power excavation is confined to steam shovels. In Massachusetts and Connecticut steam shovels, derricks, locomotive crane clamshells, and centrifugal pumping are the methods used for exca-

*Reprinted from May issue of "Public Roads," Bureau of Public Roads, U. S. Department of Agriculture.

vating. At West Peabody, Mass., there is a pumping plant which is unique in that it delivers its product to the screens by two stages; a centrifugal pump on a boat in a pond delivers the material by a 12-inch pipeline to a hopper on shore, whence it is boosted by another centrifugal pump up a 400-foot incline to the top of the screening plant 100 feet above.

The States of Vermont and Rhode Island use local-type pits only.

The Middle Atlantic States

In New York State, most of the plants produce their sand and gravel from banks of glacial origin, but dredges are operated in Long Island Sound and in the Niagara River. The land plants in this state excavate with steam shovels, mechanical diggers, derricks, and locomotive crane clamshells and cableway draglines. The Niagara River dredges, operating near Buffalo, are centrifugal-pump boats and one ladder dredge, with gravity screens which separate the sand and gravel. The product is brought to yards at Buffalo, where it is unloaded by clamshell cranes. The Long Island Sound plants use clamshell dredges, and the material is towed to screening and washing plants on shore.

Land plants in New Jersey operate in bank sand and gravel by means of steam shovels, mechanical diggers, derricks, locomotive crane clamshells and cableway draglines, and by pump boats with pipelines which discharge to gravity or cylindrical screening plants. Operations in the Delaware River are confined to ladder dredges, which work between Philadelphia and Trenton.

There are many gravel banks in New Jersey which are operated by hand, and in which the material is loaded directly from the bank to wagons, trucks, and railroad cars.

In Pennsylvania, most of the sand and gravel plants occur in the glacial deposits of the northern part of the state. A few land plants occur elsewhere, in old river terraces. Much sand and gravel is also taken from the Delaware, Allegheny, Monongahela, Ohio and Susquehanna Rivers. In this state, four hand-operated plants have a sufficiently large production to justfiy their inclusion in the tables which follow. Of the plants which operate by strictly dry excavation methods the majority use steam shovels. One locomotive-crane clamshell is in operation and three cableway draglines. Two plants use cableway draglines for excavating from small streams. The 20 plants obtaining their material from the larger rivers are evenly divided between pumping boats and ladder dredges. In the Pittsburgh district, ladder dredges are used exclusively for river work. Revolving cylindrical screens are used on the dredges and the products delivered to barges alongside, the latter being towed to yards along the river bank.

In the Williamsport district, centrifugal pump boats are used exclusively, all material being otherwise handled as in the Pittsburgh district, except that a few use gravity screens only. In the Philadelphia district, both ladder and clamshell dredges are used for river work. Material is screened on the dredges and delivered by barges to storage yards in Philadelphia and other points. There are no pump-boat plants operating in Pennsylvania.

The states of Delaware, Maryland, and the District of Columbia may be considered together. In this area, the sand and gravel is obtained locally, mostly from old river terraces and small streams. The Delaware plant operates on a large scale, excavating with derrick clamshell, in sand dunes, originating from beaches on the Delaware Bay. In Chesapeake Bay and the Potomac River, ladder dredges are used. The material is usually washed and screened on the boat, and the product delivered to barges. Excess sand is discharged from the side of the boat. Unloading on shore is done with the use of derrick clamshells. Some dredges, however, deliver by barge to washing and screening plants on shore. Among the inland deposits of sand and gravel, other than the sand dunes referred to above, sand and gravel deposits, varying in thickness from 12 feet to 30 feet, are worked by steam shovels and derrick clamshells.

Some gravel and an abundance of sand, of excellent grade, occur in the Cretaceous, Tertiary, and Quaternary formations on the eastern shore, and in the Palaeozoic formation of Western Maryland. Sand also occurs in the tidal streams and estuaries, from which it is extensively dredged. A short account of sand and gravel in this state may be found in the Maryland Geological and Economic Survey, Report of 1908, Part II, Volume VIII.

Virginia and West Virginia

In Virginia, there are 14 sand and gravel producers of the class under discussion in this article. Sand and gravel

State.	Number of plants.				Daily capacity, tons.	1919, tonnage.	1920, estimated tonnage.	Increased, tons.	Decreased, tons.	1920, tons used on roads.	Claims of car shortage effect on production at various plants.			
											1919		1920	
	Total.	Wet.[1]	Dry.[1]	Both.							Number affected.	Per cent reduced.	Number affected.	Per cent reduced.
Maine	3	.....	3	.....	900	57,000	77,000	20,000	.....	9,200	0	.....	1	50
New Hampshire	1	.....	1	.....	210	30,000	35,000	5,000	.....	5,250	0	.....	1	15
Vermont[2]	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Massachusetts	12	1	11	.....	9,885	674,000	968,000	294,000	.....	147,600	0	.....	3	20 to 70
Rhode Island[2]	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Connecticut	10	2	8	.....	2,750	326,000	360,500	34,500	.....	69,850	0	.....	1	90
New York	26	6	20	.....	28,615	2,867,600	3,469,700	602,100	.....	846,850	5	25 to 60	9	15 to 75
New Jersey	25	5	18	2	26,425	1,967,000	2,352,000	395,000	.....	956,850	15	5 to 75	15	5 to 75
Pennsylvania	50	18	32	.....	50,200	4,936,000	5,633,200	697,200	.....	1,229,650	19	10 to 50	26	10 to 75
Delaware	2	.....	2	.....	700	60,000	44,000	.....	16,000	26,000	2	25 to 50	2	50
Maryland and District of Columbia	10	3	7	.....	12,250	1,907,000	1,802,170	.....	104,830	470,100	7	10 to 33	7	10 to 40
Virginia	14	3	11	.....	17,650	1,101,000	1,046,900	.....	54,100	356,000	7	15 to 80	11	25 to 60
West Virginia	18	13	5	.....	10,000	465,400	526,400	61,000	.....	216,500	13	10 to 90	16	10 to 90
Ohio	78	33	43	2	71,120	4,287,150	5,369,500	1,082,350	.....	1,818,125	36	5 to 80	40	10 to 90
Kentucky	12	10	2	.....	14,040	877,750	1,089,750	212,000	.....	180,800	6	25 to 50	5	20 to 60
Indiana	63	33	30	.....	59,825	4,380,400	4,225,500	.....	154,900	1,687,800	29	10 to 95	33	15 to 95
Illinois	51	22	27	2	79,225	5,467,800	5,425,000	.....	42,800	2,944,000	35	6 to 85	38	20 to 90
Michigan	51	20	31	.....	59,415	4,320,085	4,847,000	526,915	.....	1,403,565	32	10 to 75	39	10 to 90
Wisconsin	35	3	32	.....	33,750	1,979,942	3,211,000	1,231,058	.....	883,700	17	10 to 60	18	25 to 90
Minnesota	32	6	26	.....	20,835	838,964	1,676,000	837,036	.....	497,700	8	30 to 70	11	40 to 90
South Dakota	3	.....	3	.....	2,400	(3)	78,000	.....	.....	25,000	0	.....	0	.....
Iowa	71	42	29	.....	57,540	2,055,873	2,661,000	605,127	.....	642,000	38	10 to 80	49	20 to 85
	567	220	341	6	557,735	38,598,964	44,897,620	6,593,286	372,630	14,416,540	269	5 to 95	325	5 to 95

[1] Wet and Dry, as used here, apply only to excavation and not to screening method.
[2] Local pits only.
[3] Started 1920.

In the statistics above, small, locally used sand and gravel pits are not included. These, however, are abundant, especially in the northern States.

Table 2—Permanent-type commercial sand and gravel plants in 22 North Central and Northeastern states

deposits may be found along many streams and in river terraces. Land deposits are mostly worked by dragline excavators—two plants use cableway draglines and two plants use steam shovels. River and bay work is conducted by pumping plants or ladder dredges. These are found on Little River, 12 miles northeast of Richmond, and on the James River and Chesapeake Bay. A Baltimore corporation, which operates from Norfolk, Va., on the James River, and at Petersburg, Va., is reported as using ladder-type dredges in addition to pump-boats. Land deposits are relatively thin. None of those at present being worked exceed 25 feet in thickness. Operation in these deposits is therefore relatively expensive. Plants operate the year round in this state.

In West Virginia, sand and gravel deposits are comparatively scarce. Exclusive of small hand-operated pits only six land deposits are worked. Operations at these are conducted by derrick clamshells, cableway draglines, steam shovels, and horse scrapers. River deposits are worked by 14 producers, the operations of which are equally divided between centrifugal pumps and ladder dredges. Land plants use gravity screens only. Ninety-five per cent of the sand[1] produced in West Virginia is dredged from the Ohio and Elk Rivers or pumped from smaller streams. The ladder dredges on the Ohio and Elk Rivers are equipped with screening plants, whence material is towed to shore in barges. It is then delivered to storage piles or hoppers for truck and railroad car, loading by clamshells. A few plants further subdivide their material by shore screening. The stream pumping plants in West Virginia operate with 6 and 10-in. centrifugal pumps, some of which discharge to barges, and others, by pipelines, to gravity screens on shore.

[1]Consideration of crushed sandstone plants, which are numerous in both West Virginia and Pennsylvania, is omitted in this paper.

Ohio and Indiana Have Many Large Plants

In Ohio, sand and gravel beds are widely distributed and, over much of the state, are of glacial origin. Forty-five land plants are included in the list of this survey. Twenty-seven of these are operated by steam shovels. There are no mechanical diggers or dragline scrapers in operation in the state.

All other methods of excavation, however, are used, there being a greater variety of methods of operation found in Ohio than in any other state studied. Large, modern-type plants are common.

Pumping and dredging plants operate in Lake Erie, the Ohio River, and in some of the smaller rivers of the state. The three types of dredges (ladder, dipper, and clamshell) are found in this state. Eighteen plants excavate by centrifugal pumps. Some screening is done immediately on the dredges, but some pump-boats deliver by pipelines to screening plants on shore. On Lake Erie, the method of operation is pumping, the material being delivered to barges.

The State of Indiana is remarkably well supplied with sand and gravel, and commercial, permanent-type plants are found in all parts of the state with the exception of a portion of its southern extremity, which was unglaciated, and a few counties in the northwestern part of the state. Southern Indiana is well served with these road materials through deposits taken from the Ohio and Wabash Rivers. For local use in the southern part of the state there are widespread deposits of stream gravels mixed with iron carbonate nodules, which are residual from the decomposition of shale and clay strata. Stream gravels occur generally over the state, and consist mostly of reassorted materials from glacial drift. The sand and gravel land plants in this state number 52. The majority of these excavate with cableway draglines and steam shovels; a few use the dragline excavators; and a few others derrick and locomotive-crane clamshells. Excavation from the Wabash and Ohio Rivers is accomplished almost entirely by centrifugal pumps. No ladder dredges are used, and only one clamshell dredge. Hydraulic stripping was noted at a number of plants in Indiana. The operating season varies from 7 to 10 months. In 1905 the Geological Survey of Indiana published an exhaustive report on the occurrence and distribution of road materials in the state.

In Illinois, gravel deposits are scarce in the central, eastern, and southern portions of the state, and these districts are served through plants on the Mississippi River, at the mouth of the Ohio River, and on the Wabash River. This statement, while true in general, applies specifically to deposits suitable for commercial development on a large scale. There are 55 permanent-type sand and gravel plants in Illinois. Of these, 32 are land plants, 5 of which operate by dragline method below water level. Sixteen of this class of plants excavate by steam shovels; two use mechanical diggers, while others use dragline cableways, excavators, and scrapers, and both derrick and locomotive-crane clamshells.

State.	Dry excavation.						Dry or wet excavation.			Wet excavation.				No report.	Total plants.	Total of all methods at all plants.
					Clamshell.		Dragline.				Dredges.					
	Steam shovel.	Mechanical digger.	Horse scraper.	Hand.	Derrick.	Locomotive crane.	Cableway.	Excavator.	Scraper.	Pump.	Ladder.	Dipper.	Clamshell.			
Maine	2														2	2
New Hampshire	1														1	1
Vermont[1]																
Massachusetts	5				1	4		1		1					12	12
Rhode Island																
Connecticut	1				1	1		3					1		7	7
New York	8	1			3	2	1			4	1		1		20	21
New Jersey	11	1			3	1	1			5	2				24	24
Pennsylvania	11			4		1	5			10	10	1			41	42
Delaware					1										1	1
Maryland and District of Columbia	3				1						3				7	7
Virginia	2						2	5		4					13	13
West Virginia	1		1		3		1			7	7	1			20	21
Ohio	27		2	1	2	4	8	1		18	3	2	1	2	69	71
Kentucky	3							1		7			1	1	13	13
Indiana	17				2	6	23	4		13			1	1	65	67
Illinois	16	2			2	1	5	4	2	23					55	55
Michigan	19		1		3	7	15	6	1	5			2		57	59
Wisconsin	11	4	1		1		8	2	3	1			1		31	32
Minnesota	7	2	1		1		6	2	2	5			1	1	27	28
South Dakota	1						1		1						3	3
Iowa	4		2		1	3	12	4		43				1	68	70
Total	150	10	8	5	25	30	88	33	9	146	26	4	9	6	536	549

[1] Locally used pits only.

Table 3—Showing number of plants using various sand and gravel excavation methods

The state highway department of this state has published, in its Bulletin No. 14, a report on "Materials Available for Highway Construction in Illinois." The Illinois Sand and Gravel Producers' Association has a comprehensive report on the sands and gravels of the state, which is known as "General Letter No. 24."

Michigan's Glacial Gravels Inexhaustible

Michigan, like New England, has an apparently inexhaustible supply of glacial gravels, occurring in the form of ridges, known as "hog-backs" and eskers, in irregular hills called "kames" and in outwash plains and deltas. There are enormous deposits of gravels also in the old beach ridges in Presque Isle and Alpena counties, bordering on Lake Huron. The latter gravels, however, are chiefly of limestone and of low grade. Sand and gravel plants occur wherever there is demand for material. Most of them are in the southern half of the state. There are 57 plants in Michigan, two of which use more than one method of excavation; 50 of these are dry land plants. The steam shovel and cableway dragline methods of excavation prevail. One plant uses a dragline scraper; six, dragline excavators; seven, locomotive-crane clamshells; and three, derrick clamshells. In this state, many of the plants using cableway dragline excavators deliver to a stock pile over a tunnel which feeds to conveyor belts leading to screens. Of the seven distinctly wet-class plants in Michigan, one should perhaps be included in the class of land plants, as its operations are in a glacial deposit, and the sand and gravel is pumped through a 15-inch pipeline from an artificial lake. This plant is operated as is one, described above, in Massachusetts. At the Michigan plant material is picked up in the lake by a centrifugal pump, which is driven by a 400-horsepower electric motor. It is then conducted 300 feet through a 15-inch pipeline laid on pontoons. A booster pump on shore delivers the material up a 200-foot incline of 20 degrees to screens.

In the St. Clair, Detroit, and St. Joe Rivers and Lakes St. Clair and Erie, operators excavate sand and gravel by means of clamshell dredges and centrifugal pumps. In this state, the stripping is comparatively thin and at most plants the overburden is carried to the plants, and eliminated by washing. The operating season varies from 75 to 250 days per year.

An account of the road materials of Michigan may be found in publication No. 27, Geological Series No. 22, of the Michigan Geological and Biological Survey for 1917 and prior years.

Wisconsin Well Supplied

Few states have a greater abundance of road material than has Wisconsin. Suitable materials are found in nearly every county. The southwestern quarter of the state is free from "drift." Elsewhere glacial sand and gravels are common. A great majority of the producing plants are located in the southeastern quarter. Thirty-one permanent-type sand and gravel producers operate in this state. One of these, only, produces from Lake Superior. This company excavates with clamshell dredges and occasionally takes gravel from beaches, bringing the material within reach of the clamshell by means of dragline scrapers. One plant operates a centrifugal pump-boat in an artificial lake. At this plant the material is delivered through a 10-inch pipeline to a settling pit, whence it is loaded direct to cars, without screening, by clamshell. Eleven land plants excavate with steam shovels and eight with cableway draglines. Derrick clamshells, dragline excavators, and scrapers are also used. In Wisconsin mechanical diggers are more extensively used than in any other state. The latter may be seen to good advantage at Janesville, where they are operated by electric power and deliver to conveyor belts from high banks of loose material—favorable conditions for these machines.

Indiana Sand and Gravel Men Confer with Highway Commission

A CONFERENCE between the Indiana State Highway Commission and the Indiana Sand and Gravel Producers Association was held recently in Indianapolis. The gravel men gave a general survey of the sand and gravel industry and submitted data to the commission showing that they were selling their material at less than cost at the present time. Particular stress was laid on the high freight rates and the commission was urged to exert its influence toward the lowering of the present rates. It was the unanimous opinion of the producers in attendance that there could be no drop in prices of sand and gravel until freight rates are adjusted.

The conference was attended by Messrs. Huffstetter, W. K. Miller, G. V. Miller, Owen, Abe Hart, Swango, Oliver, Nattkemper, M. A. Neville, Steinberg, Bedford, Theobald, Kirkham and D. Yeoman.

Illinois Company Borrows $4,000,000

THE UNITED STATES BUILDING MATERIAL CO., Chicago, which several weeks ago took over the Producers' Material Co. and the U. S. Crushed Stone Co., has given a trust deed to the First Trust and Savings Bank of Chicago for $4,000,000, 10 years, at 8 per cent, on its properties. Of this amount, $2,000,000 is to be used at once, the balance to be held for future developments. The same interests control the U. S. Building Material Co. and the Cook County Supply Co.

Opportunity for Capital in Radford, Va.

OPPORTUNITIES for investment in and around Radford, Va., are outlined in a recent letter from C. A. Beinkamper, of the Virginia Produce Co., Radford, Va., who catalogs the region's undeveloped resources in these terms:

"As to our mineral resources we have more undeveloped mineral wealth within a radius of 50 miles of Radford than I think can be found in any other section of the country. We have:

"1. A water hone whetstone quarry practically of the same class and nature of stone as the celebrated German water hone made by Esher & Son for over 150 years. There is quite a large deposit and after cutting the stone we can use all of the refuse.

"2. Two or three limestone quarries of high grade stone situated from five to fifteen miles from Radford.

"3. New River, which flows past Radford, has a quantity of sand and gravel of good quality which, with proper equipment, can be handled to good advantage and a ready market for the output can be had.

"4. In and adjoining Radford we have extensive deposits of paint material in the nature of ochre of different colors.

"5. Right near us there are several undeveloped quarries suitable for crushed stone for ballast, etc. We own two small quarries within the corporate lines. On one we built a small kiln last year and want to put in a grinding outfit for agricultural and building lime. The entire output can be sold locally.

"6. This point has plenty of good clay for brick manufacture, also good opportunities for concrete brick, block and other concrete products.

"7. From soap stock combined with mineral we make a soap that can be manufactured as cheaply as the best and has merits few others possess. Also a polishing compound for glass and all kinds of metal.

"8. Within a few miles of Radford there are indications of good deposits of a semi-anthracite coal. Within 10 miles there are a number of coal mines in operation.

"9. There is an urgent need for houses that can be sold or rented. We own about 80 lots in the city near the several industrial works. Among them are two or three groups of lots lying near the railroad and suitable for industrial plants.

"Radford has some 6,000 population, street car service, city water, electric lights and power for plant operation. It is situated on the banks of New River and upon the main line of the Norfolk & Western Railroad."

Gravel for Gravel Roads

No. 1.—Geology of Sand and Gravel Formations and Why Some Gravels Are Better for Gravel Roads Than Others

SAND AND GRAVEL as aggregates for concrete have been pretty thoroughly studied and tested, but sand and gravel for gravel roads, or gravel-macadam roads, have not been the subject of any very scientific investigation. Several states have had considerable success with gravel roads as secondary thoroughfares, notably New Hampshire, Vermont, Indiana, Michigan, Wisconsin and Minnesota. In the first two states gravel roads serve quite generally as main thoroughfares. Of all these states probably New Hampshire has had the greatest success with gravel roads and has made the most thorough study of them.

A recent report of the New Hampshire State Highway Commissioner, Frederic E. Everett, contains the results of an investigation of native gravels, which are of general interest to the whole sand and gravel industry. The investigation and study was made by James W. Goldthwait, State Geologist, and Wallace F. Purrington, State Chemist, and they state in their conclusion that they have endeavored to combine science and common sense in this report.

Problems Involved in the Study of Gravel

Definition of Gravel—Gravel is a mixture of water-worn pebbles and sand, in which pebbles usually predominate. It is always stratified, because while it was being formed the currents of water varied in strength, bringing first coarser and then finer sediment, alternately, until they ceased to operate. It may be formed by rivers, where sediment stops, for a time, on its journey to the sea, or along shores where waves and 'longshore currents sweep stones through shallow water and cast them up in beach deposits. The coarse aggregate or pebbles are more or less spherical or oval in form, as the result of abrasion while they were rolled along. The finer part of the aggregate or "matrix" may include clay, but is usually sandy, since currents strong enough to bring pebbles are usually too strong to leave clay at the same place.

Increasing Importance of Gravel for Road Construction

To meet the increasing demand for good gravel on roads where traffic is moderately heavy, and funds are limited, large deposits of hard gravel must be found, at points accessible to railways, so that the material may be widely distributed to projects within easy hauling distance. Location, volume available, and durability of the gravel are important factors. The first two have to be settled in the field; the last one, in the testing laboratory.

Old and New Methods of Locating Gravel—Most of the deposits of gravel in the State are already known to the local road agents and selectmen, who have encountered the gravel either by chance or by deliberate prospecting as local needs gave incentive. Gravel turned up in plowed ground, in excavations for walls and cesspools in postholes for fences or telephone lines, or in the preliminary grading of the road itself, accounts for the discovery of nine-tenths of the banks now in use. Even a freshly dug woodchuck hole may point the way to gravel at a place where neither road agent nor geologist would see reason to expect it. Following any of these clues, a careful prospector tests the quality and extent of his find by digging test pits before developing the bank.

These simple practical methods have suffered until recently, because long occupancy of a country which is rather evenly settled and mostly under cultivation had brought to light the fact that gravel banks occur in nearly every town. But with the increasing use of gravel came the search for more and better material until it became apparent that in some towns the supply was almost gone. The business of gravel prospecting has thus come to be made more of a science than before. There are several outstanding facts about gravel deposits, known to those who have studied their origin, which are a distinct help to the prospector. The topographic form of a gravel deposit may be as reliable a guide to the discovery of a new bank as the showing of gravel on the surface of a freshly plowed field.

Someone has remarked that if given an Italian and a shovel he would find more gravel than a geologist could. Reason and experience indicate, however, that both the shovel and the geological understanding are essential to any thoroughgoing and economical search for gravel. One illustration is perhaps enough. In a certain New Hampshire town, where new road construction was contemplated, several years ago, a new gravel pit, located by the simple, practical methods, was purchased and opened by a street railway company. It was located on a road corner, on a flat plain, on the outskirts of town. Knowing that gravel was actually in sight, and assuming, quite correctly, that the deposit extended as far as the plain itself, the agents of the town purchased a small tract on the opposite corner, and prepared to develop a gravel pit for road material. Soon after this purchase had been effected, the deepening excavation of the street railway company's pit disclosed the fact that gravel was limited to the topmost three or four feet of the plain, and that beneath that it was all sand. The town pit, accordingly, has never been opened. It is true that the sinking of test holes to a greater depth than is usual might have prevented this poor investment of town funds; but it is also true that the shallowness of the gravel deposit could have been foretold by anyone acquainted with the geological history of these broad washplains. Such knowledge is so easily acquired that it is absurd to ignore the practical value of it.

Determining Quality of a Gravel Deposit

The problem is a geological one. It can be solved only by a thorough reconnoissance of bedrock and glacial geology of the State, together with tests in the laboratory. Most of the samples have been picked to represent the quality of gravel on a certain bedrock area, of granite, slate, or schist; or in a district where the mixture of stones is known to be particularly strong or weak. Some of them have been collected so as to include a certain town on the list, although there was perhaps little reason to expect that the gravel from that town would be found to differ much in composition and strength from that of an adjoining town already on the list. In a large number of cases the sample was taken from a bank which was being considered, in connection with important construction, in competition with other banks.

The reports from the laboratory, on these samples, checked up by actual experience in the use of many of them on the roads, make a satisfactory basis for judging the probable quality of gravel at any new locality, in connection with future projects. The strength of our gravel has been found to be controlled directly by the proportion of stones of different rock types in the mixture. These proportions have been counted and the sources of the stones, in all cases, looked up on the geological map; and field studies have made it possible to predict what sort of a mixture of granites, quartzites, slates, schists, and other rocks may be expected in any given town or district, and thus to predict where the strongest gravel may be found.

The Occurrence and Origin of Gravel Deposits

General Distribution—In New Hamp-

shire, as elsewhere, gravel deposits are most numerous and extensive in valleys, where flowing water has worked, and may still be working. This is fortunate, since it makes gravel accessible to the most traveled roads, and to railway lines, both of which follow the valleys. Most of these banks of gravel and sand were left at the close of the Ice Age, when flooded streams circulated through and beyond the ice sheets laying down their heavy loads of sediment. Every wide valley also has its modern floodplain, or "intervale," where the river, ever curving and shifting, gathers and re-distributes the pebbles and sand. Up on the hillsides, however, gravel deposits are generally missing, at least above the level reached by the temporary streams of late glacial time.

The most widespread gravel and sand deposits in the State are along the coast.

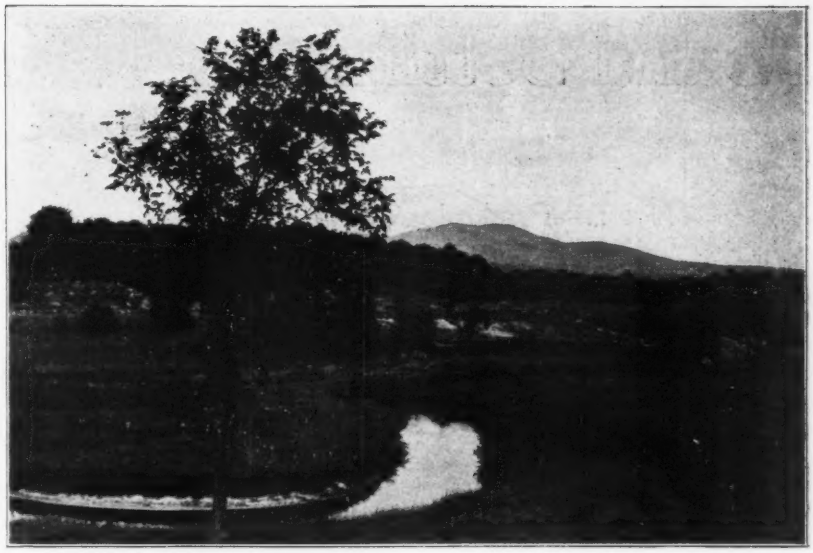
River Gravels—Under this head are included such deposits of gravel as are found along stream courses. They may be divided into stream-bed gravels and floodplain gravels.

Stream-bed gravels commonly occur as bars along the channels of streams where stones and pebbles, rolled or washed along while the water is deep and swift, are caught on their way down valley, as the stream weakens, and are left in the channel or at its edge, awaiting the next rise of water and revival of the current. The coarseness of the gravel or sand depends upon the velocity of the stream at the time; and the amount laid down depends mainly upon the length of time during which the current is maintained.

Since all these and other factors are variable, bars of gravel may be large or small, and may consist of material of fairly uniform size, or of successive layers of different texture. Two features favor this use even where the streams are small and the deposits likewise limited in extent, especially where small supplies are needed every season, to maintain roads already built: (a) the gravel is replenished at each season of flood, as the river channel shifts and new material is washed downstream; and (b) it is very resistant to wear, because recent rolling and abrasion of the stones has removed the chemically softened surfaces they may have had.

Floodplain gravels are stream-bed gravels which have been spread out widely, as the curving channel shifted and a bar on the inner side of the curve was extended along the flat valley floor. Gravelly floodplains usually have a noticeable slant down valley, while sandy ones are flat or nearly so; for a stream with a strongly descending grade flows faster and carries larger stones than one which has but a faint slope and slower speed. Many of the small tributary valleys of the State have narrow floors built of stones too coarse and cobbly for use in road construction (except where these are soft and slaty, and perhaps will pack down under moderate traffic). Most of the large rivers, which flow in wide open valleys, have floodplains too sandy to be suitable for roadwork, although bars of gravel may show in their beds, below rapids or at the foot of caving gravel banks. It should be noted that many floodplains which show only sand or silt at the surface contain good gravel at a depth of only two or three feet, where the old channel deposits have been buried by the finer sediment left during the subsiding of the last floods.

(To be continued)



Flood-plain and outwash terrace near Andover, N. H.

The Phosphate-Rock Industry in 1920

THE PHOSPHATE-ROCK INDUSTRY in the United States in 1920, according to figures from all producers compiled early in April by the United States Geological Survey, Department of the Interior, made a record far surpassing that of any previous year. The quantity of phosphate rock mined and sold was 4,103,982 long tons, or nearly a million tons more than in the record year 1918. The total receipts from sales was $25,079,572, or more than twice as much as in any other year. The average price per ton for the entire output was $6.11, as compared with $5.10 in 1919.

Florida's output more than doubled, the quantity of land pebble phosphate increasing by more than 1,500,000 tons. South Carolina produced 27 per cent less than in 1919, but Tennessee increased her output 100,000 tons, or 18 per cent. A most notable feature of the year was an increase of 223 per cent in the production in Idaho and Utah. The Western output, most of which was made by Idaho, jumped from 17,000 tons in 1919 to more than 55,000 tons in 1920.

PHOSPHATE ROCK EXPORTED IN 1920

	Long Tons	Value
High-grade hard rock	344,896	$ 4,496,457
Land pebble	693,355	5,593,814
All other	31,761	500,904
	1,070,012	$10,591,175

The total exports in 1919 were 378,731 long tons, valued at $3,567,982. The following tables summarize the industry for the last eight years:

PHOSPHATE ROCK MARKETED IN AND EXPORTED FROM THE UNITED STATES, 1913-1920

Year	Marketed Long Tons	Exports Long Tons	Proportion of Exports to Domestic Production Per Cent
1913	3,111,221	1,366,508	44
1914	2,734,043	964,114	35
1915	1,835,667	253,421	14
1916	1,982,385	243,678	12
1917	2,584,287	166,358	6
1918	2,490,760	143,455	6
1919	2,271,983	378,731	17
1920	4,103,982	1,070,012	26

PHOSPHATE-ROCK MINED AND SOLD IN THE UNITED STATES, 1919-20

State	1919 Quantity Long Tons	1919 Value	1919 Average Value Per Ton	1920 Quantity Long Tons	1920 Value	1920 Average Value Per Ton
Florida:						
Hard rock	285,467	$ 2,452,563	$ 8.59	400,249	$ 4,525,191	$11.31
Soft rock	14,498	196,318	13.54	13,953	190,551	13.66
Land pebble	1,360,235	5,149,048	3.79	2,955,182	14,748,620	4.99
	1,660,200	7,797,929	4.70	3,369,384	19,464,362	5.78
South Carolina:						
Land rock	60,823	308,968	5.08	44,141	367,209	8.32
Tennessee:						
Brown rock	475,475*	3,123,565	6.57	556,177	4,425,761	7.96
Blue rock	58,550	290,951	4.97	78,671	518,234	6.59
	534,025*	3,414,516	6.39	634,848	4,943,995	7.79
Western States†	16,935	69,855	4.12	55,609	304,006	5.47
Total	2,271,983	$11,591,268	$ 5.10	4,103,982	$25,079,572	$ 6.11

*Includes brown rock from Kentucky. †1919: Idaho, Utah and Wyoming; 1920: Idaho and Utah.

Sand Settling and Sand-Settling Devices

No. 1.—Principles of Hydraulic Separation—Definition of Terms

By Edmund Shaw
Allen Cone Co., El Paso, Tex.

IF WE THROW SAND into water it will settle, but the rate at which any particular grain will settle depends upon a number of conditions. Hence there are differences in the rate of settling, or the speed with which a grain will fall in water.

By taking advantage of the differences in falling rate we may obtain a number of results so important that they are considered to be distinct processes and have names of their own. If the sand consists of a mixture of grains of light and heavy minerals we may separate the lighter from the heavier, more or less completely, which is *concentration*. If the grains are all of the same mineral but of different sizes we may separate the coarser from the finer grains, which is *classification*. If the water has another substance, such as clay, in suspension, we may settle the sand away from it, obtaining a practically clean sand, which is *desliming* or *sand washing*. And finally we may settle the sand out of the water by which it is carried to the plant, which is *dewatering*.

It is important to note that all the above processes may be carried on as continuous processes; that is, the devices which do the work may be fed continuously and the products removed as fast as they are made. This continuous feature is of great value in the practical application of settling to industrial processes.

Very many industries employ one or more of the above-named processes. They are the foundation of such industries as coal and iron ore washing, the milling of ores, the fine grinding of many substances such as whiting and barytes (where these are ground wet), the grading of abrasives, the preparation of many chemical substances, and, what especially interests the rock products man, the recovery and preparation of building and other sands and the grading of the same into sizes.

Application in Sand and Gravel Plants

The settling of sand and sandy materials seems such a simple matter that very little attention is usually given to it, where it is employed as part of a process. Yet, it is no exaggeration to say that millions of dollars are lost annually from ignorance or disregarding of the laws of settling. The writer could prove this by a great many instances which have come under his observation. To give only three examples, a plant washing phosphate rock showed an increase of nearly $400 per day in the value of its product after the settling conditions had been studied and the proper equipment provided. In the same way the product of a gold mill was increased $160 per day, and the product of a small mill treating copper ore was increased $80 per day. In all three cases the additional equipment required was simple and the cost was so low that it was paid for in the first month after it had been installed.

In the case of such low-priced materials as common sand and the various ground rock products it has often been considered cheaper to allow a part to go to waste rather than spend money for additional equipment to save it. But this policy is usually a mistake. The market is constantly expanding, and the proper cleaning and grading of such waste products will usually make them readily saleable. Since the material has already been mined, or dug, and has had considerable money spent upon it to bring it to the plant, any profit which may be made from these wastes is cheaply obtained. It is by the saving of wastes (fines and the like) that the success or failure of a plant is sometimes determined.

Edmund Shaw

The Author

BORN in Rockland, Mass., in 1870, studied at Massachusetts Institute of Technology, which he left in his third year on account of ill health; worked at various things including teaching and journalism, until 1900, when he found employment in an ore mill in Arizona. Followed the milling of gold and silver ore from that time until 1915, being superintendent of plants in the Black Hills, Arizona, Mexico and Central America. During this period he became especially interested in classification and settling, and in 1915 joined the Allen Cone Co., which had just been formed to promote the classifying and settling devices invented by Charles Allen, of El Paso, Texas. As sales engineer for this company he has visited a large number of plants in his travels.

Definition of Sand

Everyone knows what sand is, but for the sake of exactness it is well to define the word as it will be used in these articles: Sand is a collection of loose mineral particles, the largest of which is not more than one-fourth inch in diameter, and all the particles are distinctly of a granular nature.

Where the particles are so fine that they are not granular, but form an impalpable powder when dried, the substance will be called clay, or slime, if it is artificially produced. We may note here that so far as settling is concerned the laws are the same whether the sand is natural sand from a bank or river bottom, or artificially produced by crushing rock or ore.

Principles of Sand Settling

There are a number of conditions which affect the settling rate of a grain of sand. The principal ones are:

The specific gravity (or density) of the mineral of which the grain is composed.

The mass or weight of the grain, generally spoken of as the size of the grain.

The shape of the grain.

These three have been pretty thoroughly studied and written upon in the standard text books, such as Richards' Ore Dressing,

to which the reader is referred if he desires to go deeper into the theory of settling than these articles will lead him. But there are other conditions quite as important to the practical man, which have hardly been touched upon by these writers. Two of these are:

Mass effect, or the effect of the grains crowding together in the vessel in which they are settling.

Porosity, the absorption of water by the grains and there are other conditions which affect the work, but which may be considered of lesser effect, such as the temperature of the water and magnetism.

The last may be dismissed with a word as it is only found in plants handling magnetic iron ores, where it makes a lot of trouble. As to temperature it is enough to say of it that fine particles will settle much faster in warm water than in cold. The plant which may have ample settling capacity in warm weather may find its capacity decreased in cold weather. It is also true that hot water will wash clay from sand more readily than cold water. The other conditions will be discussed in turn.

Specific Gravity. The separation of light from heavy minerals has very little application in the rock products industry. It is used to some extent to clean up glass sand by removing iron bearing minerals. The writer has recently seen some successful experiments in raising the grade of phosphate rock in this way. It is probable that concentration will find more and more applications in the rock products industry, and fortunately the subject has been very exhaustively treated in the standard text books on coal washing, iron ore washing and ore dressing in general.

Common sands, and to a large extent our common rocks, are composed of minerals having a specific gravity about the same as quartz, which is 2.6. The principal component of metal bearing ores is quartz. Hence most of the tables of falling rates and the like have been prepared for grains of this specific gravity, and they may be used either in ore dressing or the recovery and preparation of rock products. The tables given in the next section are the falling rates of crushed quartz, specific gravity 2.63, of the mesh sizes tabulated.

We may divide the minerals roughly into four classes, according to their specific gravities. The first class contains principally the coals which have a specific gravity from 1.2 to 1.5 for bituminous coal and 1.3 to 1.8 for anthracite coal. It will be noted that these are much lighter than quartz.

The second class consists of quartz, specific gravity 2.6 and such common rocks as sandstone (2.1 to 2.7) limestone (2.6) greenstone, trap, (2.8 to 3.2) and granite, gneiss, etc. (2.6 to 2.8).

The third class contains minerals of about twice the specific gravity of quartz, such as pyrite (4.5) magnetite (5.0) chalcocito (5.3) and cassiteorite (6.2).

The fourth class contains the heavy minerals such as wolframite (6.9), galena (7.5) and native copper (8.5).

It is obvious that the specific gravity of the grain will have an important effect upon its settling rate, and also upon the proportions of the device in which it is settled. It will take a very much larger settling box to catch fine coal than to catch quartz sand of the same mesh size. When we come to the very heavy minerals, such as galena, the difference is more marked. Roughly speaking, a grain of quartz and a grain of galena of only one-fourth the diameter will settle at the same rate, hence a settling box need have only one-fourth the area to catch galena concentrates that would be required if it were to be used for catching quartz sand.

(To be continued)

Wisconsin Aggregate Producers Meeting

V. O. Johnston, President, National Sand and Gravel Producers' Association, Discusses Merits of Co-operation

AT THE REGULAR monthly meeting of the Wisconsin Mineral Aggregate Association held in Milwaukee, May 27, 1921, V. O. Johnston, president National Sand and Gravel Producers Association, was the principal speaker.

Discussing the necessity for co-operation in a national way he stated that such co-operation was indeed necessary if sand, gravel and crushed stone men were to get their just deserts. Regarding organization as a means to an end, Mr. Johnston cited the actions of the National Coal Association in obtaining a priority order for open-top cars in 1920. He pointed out that centralized rule in Washington is getting more powerful every day and that it is necessary for producers to have somebody on the job in Washington.

He further stated that the small producers of sand, gravel and crushed stone were in need of education; that they had no idea of business forms, costs or insurance. This is one of the things the National Association proposed to do—to educate the small producer. In order to do this it is necessary for all to stand together and help each other progress.

The future of the industry must be carefully considered. The speaker said he looked forward to the demand for sand, gravel and crushed stone exceeding the supply. Also, he forecast, that within the next five years the majority of producers will be hunting for new beds of raw materials. He stated that now, if there ever were any time, is the time to discount the future.

Predicting what the future held for the industry, Mr. Johnston stated that the Treasury Department of the United States had vouched for the following figures; that there is six billion dollars available for home building, school building, etc.; six billion dollars for railroad improvements; two billion dollars for public utilities and improvements; one and one-half billion dollars for highway construction and that a shortage of one and one-half million homes actually existed.

The work of a national organization, Mr. Johnston declared, should be to educate, represent and organize; that the sand, gravel and crushed stone industry did not know, within a good many million dollars, the actual value of its products; that it was necessary for the industry to know itself before it could reach the public eye.

In closing, Mr. Johnston stated that the association members must become fighters. He looks forward to having an association that will cover every branch of the industry and he invited the Wisconsin Mineral Aggregate Association to join the National Sand and Gravel Producers Association to aid in achieving that purpose.

The remainder of the meeting was devoted to an informal discussion on freight rates and insurance policies. O. C. Hubbard, secretary of the association, stated in his report that the movement for one rate for sand-gravel and crushed stone plants for compensation insurance was progressing very rapidly.

The association decided to have no more meetings this summer due to increased activity in business.

New Limestone Deposit Found in Oregon

ONE OF THE FEW lime deposits as yet found on the Coast was discovered by Clarence Altree on his farm near Toledo, Ore., recently. The deposits appear as an outcrop at the head of an old slide, and while the uncovered portion appears as a narrow dyke, some persons who have studied it think the whole mountain may be underlaid by limestone.

"Lime is badly needed," said Mr. Cooter, county agricultural agent, "and it is to be hoped that the deposits found by Mr. Altree will prove of such quantities and quality as to justify commercial development."

Quarry Man Has Had 16 Years With Concrete Block Sideline

Elmhurst-Chicago Stone Company, Elmhurst, Illinois, Has Been Successfully Using Limestone Screenings in Concrete Block Manufacture for a Long Time

SIXTEEN YEARS AGO the Elmhurst-Chicago Stone Co. started making concrete blocks at its stone quarry in Elmhurst, Ill., which is just outside of Chicago. At that time screenings were more or less a by-product and it was a little on the order of an experiment to use them in concrete blocks. The experiment turned out far better than was anticipated and the company is now making blocks throughout the year.

The Block Plant

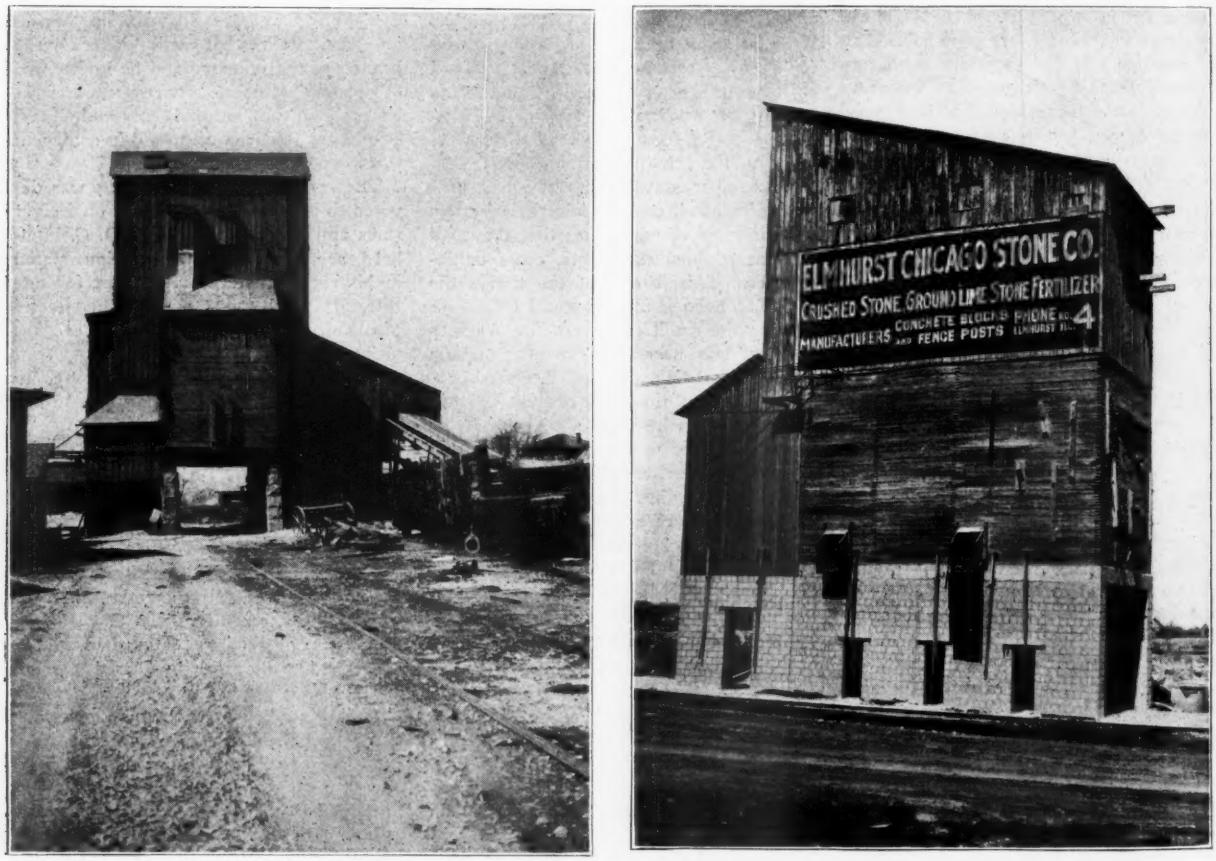
An old brick kiln has been used to house the block-making machinery. An addition was built to this kiln where the blocks are now cured by steam. The whole building covers about 100 sq. ft., half of this being used for curing rooms and half for the actual molding of the block.

A narrow-gage track runs through the entire plant and carries the blocks to the steam-curing rooms or to the outside storage piles. In the brick kiln on one side of this track is located the cement storage and a hand-operated block machine; on the other side is located the limestone screenings bin, concrete mixer, power tamper, and the boiler which furnishes steam for the curing process. In the curing shed, two curing chambers are located, one on each side of the track.

Making the Blocks

The charging floor for the concrete mixer is about 7 ft. above the ground and the screenings and cement are on this same floor level. A batch concrete mixer is used, and each batch is dumped into a hopper extending to the ground floor. From this hopper a bucket conveyor elevates the concrete to a hopper directly over the tamping machine. From this hopper mixed wet concrete is used as needed.

The finished blocks are stored on cars for removal to either the curing rooms or outside storage space. A standard-gauge track runs by the kiln from which the cement and screenings are unloaded and stored. The screenings are unloaded from the cars to a hopper on the roof of the plant directly over the storage bin by means of a locomotive crane and clam-shell. The material used is that passing a ¼-in. screen, and for facing of the

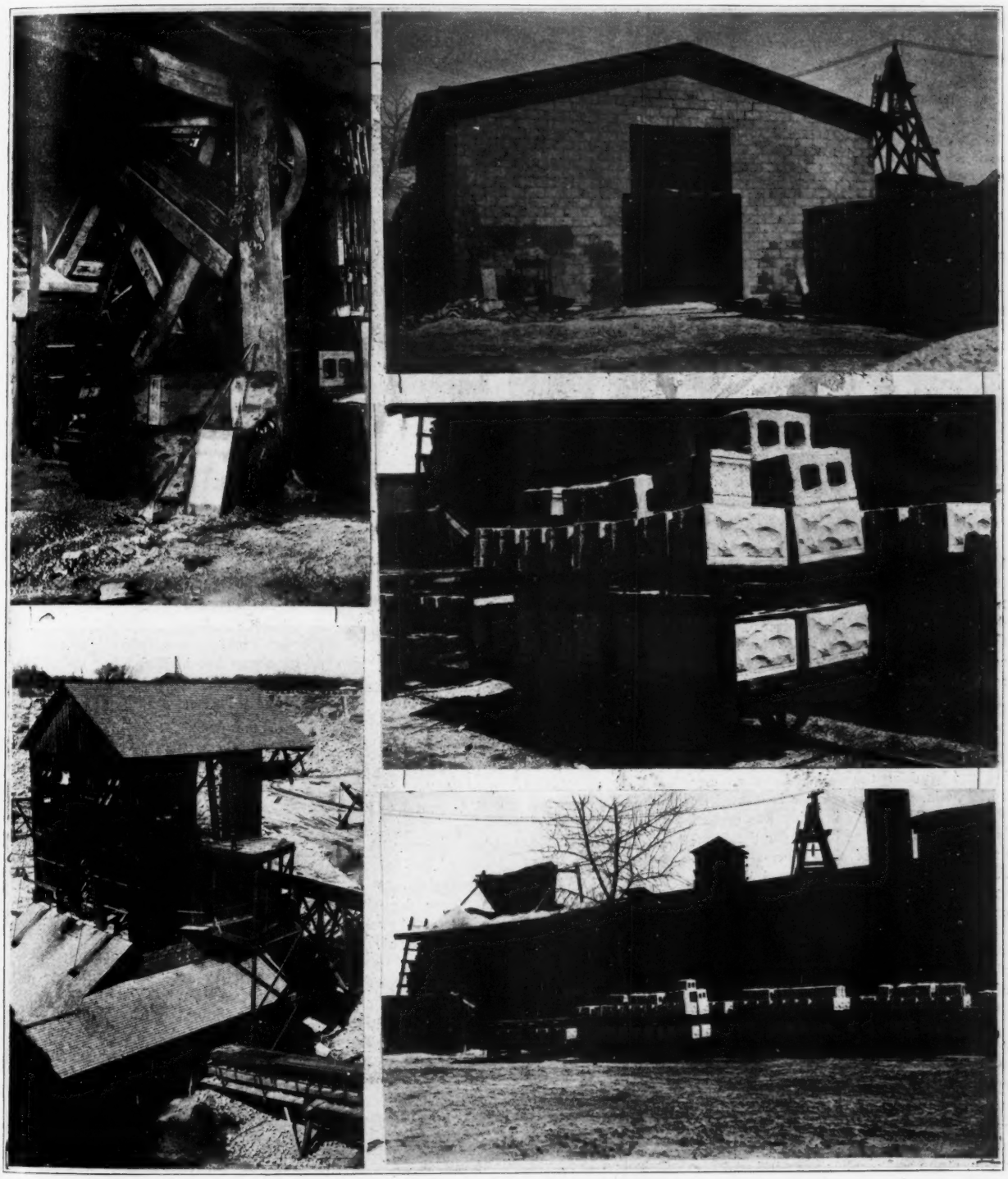


Crushing plants of the Elmhurst-Chicago Stone Co., showing concrete blocks doing hard service

blocks, that which passes a 1/16-in. screen. This material is remarkably clean and free from any signs of overburden.

Steam Curing

The curing rooms are low rooms capable of taking three tracks each and three cars on each track, making nine cars' capacity of each room. The height of the rooms vary from about 5 ft. to 7 ft., which is high enough to take the cars with reasonable headroom. These rooms are made of concrete blocks and wood. The wood naturally shows a tendency to warp a good deal under the steam and will probably be replaced later



(Upper left) Arrangement of block machine and bucket conveyor from mixer hopper to block-machine feeder. (Lower left) Initial crushing plant. (Upper right) Steam curing room. (Center) Finished product. (Lower right) Brick kiln used for block plant, showing screenings hopper on roof

on with concrete and steel. The steam is obtained from a small vertical boiler at 40 lbs. pressure and is piped to the curing rooms through 2-in. pipes.

Each curing room contains one pipe (about 1¼-in.) extending the length of the room and attached to the wall. This pipe has small holes in it, allowing for the escape of steam into the room. The time of curing ranges from 24 to 36 hours. The capacity of each room varies from 288 to 351 blocks. The steam-curing process at this plant has been in use for a year and so far has proven very satisfactory, allowing them to make blocks throughout the cold winter months.

The working force used in the block plant varies according to trade conditions. With one machine in operation, the force required is three men, two on the block machine and one on the mixer. Four men are required when both the power tamper and hand tamper are in use. These men make the blocks and also do the work of storing them for curing. Under these conditions the output of the plant ranges from 500 to 600 blocks per 10-hour day. At maximum capacity, the plant would turn out about 800 to 900 blocks per 10-hour day with a working force of from six to eight men. These men work entirely independent of the quarry business, having no part in the quarry or crushing plant operations.

There is a ready market for these blocks near the quarry and nearly all of the blocks made are delivered by truck to the building site. Elmhurst is a residential suburb close to Chicago, which makes residence work there important, and the output of the block plant is almost entirely taken for such residences.

Crushed Stone Plant

Concrete blocks play an important part in the construction of the plant for crushing and handling the quarried stone. The initial 36-in. gyratory crusher is located on the quarry floor. This building was erected in 1913, using concrete blocks for the foundation and part of the super-structure. A double wall was constructed and has so far withstood the vibration of the crusher without signs of cracking.

From this initial crusher the stone is moved by a 30-in. belt conveyor to two plants, Nos. 1 and 2, located on each side of the initial crusher, but on the original ground level.

Plant No. 1 has a concrete block foundation which has been in use about 14 years. This plant has three crushers, No.'s 7½, 5 and 4, from which are turned out stone of various sizes, from ⅜-in. chips to agricultural limestone. Plant No. 2 has two crushers, No.'s 7½ and 5, from which a 4-in. stone and smaller are produced for macadam roadwork. Finer grades range from 2½-in. down to dust.

At the present time the quarry plant is being repaired for this season's operation. Some stone is being shipped from storage piles, but the making of concrete blocks, although a minor operation, is the only active one at the present time.

Mr. Wm. Hammerschmidt is president and manager of the company.

Rich Phosphate Deposit in Pacific Islands Being Developed by British

(Commercial Attache Alfred P. Dennis, London, March 29, 1921)

UP TO 10 YEARS AGO the names of the Island of Nauru and Ocean Island were practically unknown to any save the geographer and the specialist. These islands are tiny specks of land lying in one of the loneliest spaces of the Pacific Ocean about 50 miles south of the Equator and some 3,000 miles west of the South American coast.

In 1885 these islands, which were considered of no commercial value, were formally annexed by Germany. Some time afterwards phosphate deposits were discovered on Ocean Island and some years later on Nauru. One of the effects of the world upheaval of August, 1914, was the formal transfer of these German islands to Great Britain under the terms of a mandate. An agreement was made on July 2, 1919, between the governments of the United Kingdom, the Commonwealth of Australia, and the Dominion of New Zealand for the allotment of British-controlled phosphates in the Pacific Ocean on the basis of 42 per cent to the United Kingdom, 42 per cent to Australia, and 16 per cent to New Zealand.

One of the Most Valuable Deposits in the World

It now appears that the British Empire has acquired one of the richest supplies of phosphates in the world. (See Commerce Reports for September 25, 1918, and January 22 and August 3, 1920.) It is stated that the formation of these phosphate deposits has been accomplished largely through the agency of fish-fed sea birds which have left vast deposits of guano on the islands. These deposits, mingling with the lime of the coral rocks, have practically converted the whole of the islands into great repositories of phosphate of lime. These phosphate deposits run to a depth of 40 feet on Nauru and 57 feet on Ocean Island. A representative sample of this island phosphate yields the following results, according to chemical analysis made for the British fertilizer trade:

Moisture sample:	Per Cent
Water	3.87
Tribasic phosphate of lime	82.56
Ground sample (dried):	
Carbonic acid	2.06
Equal to carbonate of lime	4.69
Phosphoric acid	39.34
Equal to tribasic phosphate of lime	85.89
Oxide of iron and alumina	.76
Organic matter and combined water	2.86

Neither island possesses harbor facilities. It has been necessary, therefore, to construct jetties, of the cantilever type, running far out over the reefs. The phosphate is taken out on cars to these jetty heads and thence lightered to steamers, moored far out in deep water. Roughly, from 1,000 to 1,200 tons, under good weather conditions, can be loaded on shipboard daily from the two islands, the present annual production of which is in the neighborhood of 350,000 tons.

South Wales Co. Takes Whole British Allotment

The bulk of the phosphate so far has gone to Australia, but it is understood that arrangements have now been effected by Great Britain for taking up for home consumption its full quota. It is stated that the South Wales Basic Slag Co. (Ltd.) has just completed an arrangement between the British Phosphate Commissioners, acting in conjunction with the Ministry of Agriculture, for taking over Britain's 42 per cent allocation of the island's output of phosphate rock. This constitutes the largest transaction so far in the history of the British fertilizer industry, the previous most important deal having been in Florida phosphate rock, purchased by the British government during the War.

It is anticipated that some 180,000 tons of high-grade island phosphate will be delivered to the United Kingdom each year and after mixture with basic slag will be distributed at farmers' stations as basic phosphate at something under three shillings per unit of phosphate of lime. The present quotations of phosphate of lime range above five shillings per unit. The first consignments of island phosphate are expected to arrive in England in June.

Advocates Use of Whitewash in Coal Mines

THE NATIONAL SAFETY COUNCIL urges the use of whitewash in coal mines as a method of accident prevention. Most coal operators belong to the National Safety Council and lime manufacturers should see to it that they are following out the recommendations of the Council. A report of the engineering department of the Council, on safety in mine haulage, says:

"The use of whitewash helps greatly to improve the illumination in a mine. The rib or wall, on the clearance side, and the roof should be kept whitewashed at the head and foot of all underground slopes, planes, at abrupt changes of grade, and at curves; and, also at all stop-blocks, de-rails and switchthrows (except room switches). Shelter holes, mine doors and center-posts on side track or partings should also be kept whitewashed. It is advisable also to whitewash all dangerous low places in roof of haulage-ways, such as cross-bars, over-casts, and pipe lines."

Opportunity of Technical Men in the Lime Industry

A Strictly Chemical and Engineering Industry Now Largely Conducted Without Adequate Technical Advice—The Part the Technical Man Should Have in the Lime Industry

By Harvey S. Owen
Chief Engineer, Glencoe Lime and Cement Co., St. Louis, Mo.

PROBABLY, the broadest and most important by-path of utility into which the universal element *calcium* finds its way, is into the lime manufacturing industry.

This industry has to do basically with the carbonates of calcium, or limestones, which occur more abundantly than any other sedimentary rocks known in the universe.

Fundamentally, the process of lime manufacturing as well as the marketing of the finished products, is a highly technical business, with practically every phase in the production, sales and final use of its products offering broad, legitimate fields for the functions of the geologist, chemist, engineer and agronomist.

This realization is fast coming to the lime manufacturer, whose growing appreciation of the technical man's service, in the field of sales promotion, is evidenced by the establishment and maintenance of a highly trained corps of technical experts, comprising the National Lime Association staff at Washington, D. C.

This staff of technical experts, covering the general lime markets of agriculture, chemistry, and construction, are maintained, by the progressive element of the lime industry, to function as a technical service unit to the lime consumer, as well as to the manufacturer.

This staff of experts comprises a technical and educational bureau which has for its sole purpose and function, the study, development, compilation and distribution of reliable scientific data and information pertaining to the adaptability, merit and correct use of all lime products.

The service rendered by this technical bureau to the manufacturers towards the standardization of the products of the lime industry, as well as their value to the consumer in assisting him towards obtaining complete efficiency in his use of lime products cannot but reflect itself in more intelligent manufacturing and consumption which in turn means increased tonnage used.

Thus we see the technical man function as an indirect marketing medium for a standard universal commodity, solely through technical service.

Technical Assistance in Selection of Quarry Sites

More intimate and important, however, from the lime manufacturer's point of view, are his manufacturing processes and costs, and here, certainly, the trained technical man finds the fullest development of his legitimate field of practice.

The physical geologist is herewith presented to the industry with a brief resume of his multifold abilities to serve. Starting with his technical knowledge, he can necessarily serve in the intelligent location and purchasing of limestone deposits, which must be suitable both as to quantity and quality, the latter determination embracing a thorough technical study of the physical and chemical nature and fitness of the body of stone.

It should be remembered in this connection that all limestones vary within wide chemical and physical ranges, and some do not burn economically to produce suitable lime, this being governed entirely by the chemical composition and physical structure of the limestone, both factors being undeterminable to the naked eye of the average lime manufacturer who is not a technical man.

The limestone deposits, being the basic essential asset of any lime manufacturing business, the importance of exact knowledge governing the purchase of limestone deposits, is readily and fully appreciated.

In Quarry Operation

After having satisfactorily established and purchased suitable limestone deposits, the physical geologist, through his technical knowledge, again offers the solution to many economic problems, in his ability to map out and execute a definite scheme of quarrying operations, based on his certain knowledge of the dips, pitches and thickness of the various limestone ledges being worked. He may also, to some extent, know the general physical resistance to the efforts of labor, machinery and explosives.

As these quarrying operations represent approximately one-third of the total cost of manufacturing lime, it would seem that any possible investment in the exact technical knowledge of the physical geologist was good, economic policy.

Quarry Records

Finally the function of the physical geologist fits admirably into the compilation of official maps and records of the lime deposit holdings of any manufacturer. These records are unfortunately not found in many lime manufacturing concerns. They are, however, intrinsically invaluable in definitely fixing the total volume and exact composition of not only the various limestone deposits as a body, but of their every strata.

The value of such maps and records, as are above briefly described, cannot but appeal strongly to the progressive lime manufacturer through their added value in correctly setting up the book assets and true values of limestone deposits, and the subsequent consideration of the items of depreciation and taxes, and finally in their ability to assist in planning a definite and practical scheme of economically quarrying raw limestone of known quality to meet the exacting demands on the lime products of today.

The Chemist's Part in Lime Manufacture

Before presenting the technical function of the trained chemist to the lime industry, it may be appropriate to preface his introduction with a brief resume regarding the rapidly changing status of demand for lime products which in a large measure, justifies his entree.

Not so many years ago, the demand for lime products emanated almost entirely from the construction field, and due, probably to this fact the well-known merit of the soft, mellow, and smooth-working, wood-burned lime made by the lime manufacturer, thoroughly satisfied the prevailing demands of those times.

In recent years, however, there is noted a larger and rapidly growing demand in the chemical manufacturing industries, and in the field of agriculture as a replacement of the construction demand, which is relatively decreased.

Especially in the chemical manufacturing processes, is this rapid growth of de-

mand noted, in which the specifications are written in rigid chemical requirements, not only of the basic oxides or hydroxide of calcium, but of those lesser elements always found in limestones, and formerly considered either negligible, or as impurities. Among these lesser elements are silicon, sulphur, iron, aluminum, manganese and magnesium.

In view of these facts, and the additional consideration that over 60 per cent of the total lime products manufactured, find their way into chemical manufacturing processes, it would seem obvious that the technically trained chemist can and does serve a most important function in the industry.

The Analytical Chemist

Primarily, the chemist functions in cooperation with the physical geologist in the fundamental consideration of lime manufacturing, namely in the purchase and chemical inventory of basic limestone deposits.

These deposits should be definitely and thoroughly analyzed chemically, strata by strata, towards obtaining complete and accurate information, relative to the physical nature and elementary constituents of each strata. This information being invaluable, as it almost entirely controls the quality of the finished products, insofar as the chemical value is concerned.

Quarry explosives also afford a limited opportunity for the chemist in their proper application to the various local problems, insofar as explosives are chemical compounds, whose efficacy can best be utilized by knowing the nature of their contents and actions.

Fuel Chemistry

Most potent is the function of the chemist in dealing with study of the fuels used in lime manufacture, namely, coal, oils, and gases.

The selection of proper fuels, as well as their economic conversion into heat units, is purely and absolutely a chemical study, if correctly handled, towards obtaining the highest efficiency.

The value of any fuel is measured almost entirely by the heat units which it contains, and is capable of liberating, and these factors can be determined definitely only by the chemist in his analyses of the various chemical compounds, going to make up any given fuel.

The combustion or burning process is also entirely chemical in its nature, and the various elementary factors going to bring about the proper combination of the fuel and the oxygen of the air, can best be regulated towards economy, under the skilled supervision of the chemist.

Considering the large element of cost in lime manufacture, which fuels represent, and also their great adaptability to control by the chemist, this thought alone would seem to justify technical chemical service.

Chemical Control of the Product

Again in the finished lime products, a rigid chemical check on all shipments, seems well worth while, as these products often find their way into exacting markets, where the chemist's bond or guarantee of specific fitness, for any given purpose, carries a material as well as a decided psychological value.

Sales departments of the large lime manufacturing companies, which enjoy a widely diversified chemical business, could utilize to advantage the chemists' knowledge, in properly filling an exacting order or contract.

Plant Layout Engineering

The civil, mechanical, and electrical engineer needs no introduction to the lime industry, as the modern lime plant in its physical layout, construction and operation reflects the skill of these men, and the more modern and efficient the plant, the more this is true.

The lime plant of today is built and operated entirely on the technical principles, and laws of mechanics, hydraulics, thermo-dynamics, machine design, compressed air, framed structures, transmission, and electricity, which are thoroughly understood, and correctly applied only under the skilled direction of the trained engineer.

The really vital elements in plant construction are necessarily the producing units, or kilns, and here certainly lies the possibility for economy in good engineering. The strength, durability, permanence, shape, size, draught, and materials entering into kiln construction lie entirely within the province of the engineer. Their large cost and importance would seem to justify the most careful effort on the part of lime manufacturers, in securing the application of the best scientific principles in this regard.

A Growing Field for Technical Men

And so we finally arrive at the conclusion, based on the foregoing facts, that the lime manufacturing of today is the logical field of economical practice of the technicians, the geologist, the chemist, and the engineer.

The writer, in presenting these thoughts to the lime industry, and the technical man, does so, not with the idea of injecting any new or original thoughts into the situation, as it is believed that all lime manufacturers are probably in full realization of the foregoing facts.

The compilation of facts is offered, and based entirely in the hope that a somewhat sluggish realization may be sufficiently stimulated, and stirred towards an ultimate action which will bring the lime manufacturer and the technical man more thoroughly into a co-ordination of effort, which cannot but develop results to their mutual advantage.

In conclusion, it is obvious that the lime manufacturer, to get this result, must give a practical demonstration of his convictions regarding the value of the technical man by allowing him to take his proper place in their organization, and allowing him to function according to his lights, and abilities, and in keeping with his company's necessities, as hereinbefore described. If this is done, it cannot but reflect itself in cheaper production, better products, more intelligent use, and increased tonnage consumption.

Quarryman Elected President of San Diego Advertising Club

LESLIE B. MILLS, San Diego, Calif., president and general manager of the Southwest Onyx and Marble Co., has been elected president of the San Diego Advertising Club, a strong organization of about 200 members.

Leslie B. Mills

The company with which Mr. Mills is associated specializes in the finishing of Pedrara onyx, which is quarried about 300 miles south of San Diego, on the peninsula of Lower California, where the company controls the largest and most valuable onyx deposit in the world. Soda fountain counters, bank fixture work, dental switchboard panels and various other onyx specialties are finished at the San Diego plant of the company and shipped to all parts of the United States. Mr. Mills has been connected with the onyx and marble business in San Diego for the past 10 years.

Colored Wall Plaster*

Pleasing Effects from Colored Fiber Obtained in Experiments of the United States Bureau of Standards

By Warren E. Emley and Charlotte F. Faxon
U. S. Bureau of Standards

THE NATURAL COLOR of a wall plaster is white, or nearly so. For many years it has been customary to accept this white color as inevitable.

The quality of a plaster is indicated by its natural color in a way which is strikingly analogous to the method used for classifying diamonds. The best plasters are slightly tinted with blue; pure white plasters are of excellent quality, and the poorest grades have a buff or reddish tinge. This fact has led the plasterer and the building contractor to look with favor upon a white or bluish-white plaster because these colors are usually accompanied by excellence in quality.

On utilitarian grounds, plaster has established its position in the building industry. Its fire resistance, its heat insulating, and its acoustical properties are of primary importance. The appearance of the plaster, while admittedly and rightfully of secondary importance, is receiving more and more attention from progressive architects and builders.

The white color of plaster is sometimes objectionable in that it does not fit in with the artistic scheme which the architect is trying to evolve. It is true that the plaster may be covered with kalsomine or wall paper, but it seems to be worth while to attempt to make the plaster of the desired color in the first place.

Several attempts have been made to produce colored plaster, but the method has not proven sufficiently satisfactory to warrant its general adoption. It involves the use of a mineral pigment, which is mixed with the plastering materials. A buff or red can be obtained with oxides of iron; a gray with lampblack. It has been found extremely difficult to mix the pigment with the plaster in such a way that two batches have exactly the same tint. Deep shades of color require the addition of so much pigment that the strength of the plaster is impaired. A plaster made by this method has a dead color, which is desirable when the plaster is considered as a background for other decorations, but which has little artistic value of itself.

Colored Concrete Parallel

Some years ago, J. J. Earley developed on a commercial scale the manufacture of colored concretes by the exposed aggregate method. Many examples of the beauty of such concretes and of the flexibility of the process can now be seen in buildings, walls, and pavements of Washington. Instead of the usual crushed stone or gravel which is used as an aggregate in concrete, he uses crushed stone which is prepared from naturally colored rocks, carefully selected and mixed to produce the desired artistic effect. After the concrete has set, the surface is removed and the colored aggregate thereby exposed. At Mr. Earley's suggestion this same principle has been applied to the manufacture of a colored wall plaster.

The first step was the selection of the proper aggregate. Fortunately, this offered no difficulty. There has been on the market for many years a material known as "gypsum wood-fibred plaster." This consists of approximately 85 per cent of calcined gypsum (plaster of Paris), 14 per cent of some material such as lime or clay added to give it the necessary plasticity, and one per cent by weight of wood fiber. It is one of the many commercial forms of wall plaster, and its position in the trade is so well established that tentative specifications for it have been adopted by the American Society for Testing Materials.

This plaster is usually designed to be used without sand, the wood fiber being considered as an aggregate. The fiber is quite similar to the ground wood used in making newspaper, except that the staple is a little longer.

Dyed Fiber

The proposed process consists briefly of dyeing the fiber the desired color with aniline dyes, mixing it with the other ingredients, applying the plaster to the wall in the usual way, and then, after the plaster has set, removing its surface in such a way as to expose the colored fiber.

The first difficulty encountered arose from the lack of literature describing the behavior of aniline dyes on wood. Most of our experimental work was devoted to this phase of the subject—the testing of a large number of dyes. These tests were conducted by exposing half of a sample of dyed wood fiber mixed with the other ingredients of a colored plaster to direct sunlight for six weeks. The other half of the same specimen of plaster was kept covered. If, at the end of six weeks, one could not distinguish between the two halves of the sample, the dye was pronounced satisfactorily fast to light. Fastness to water is not essential; in fact, it is usually desirable that the dye shall "bleed" a little. The color runs into the plaster surrounding the fiber, thereby making the fiber appear to be larger than it is and making it possible to obtain the desired effect with the use of less fiber than would be possible if the dye were fast to water.

It was found that wood fiber acts quite similarly to jute in taking up dyes. Any one of the classes of dyes can be used—silk, wool, cotton, or direct. A dye which is fast to light on the fiber on which it is intended to be used will usually be fast to light on wood fiber. If the dye is fast to water, it can sometimes be made to bleed slightly by drying the dyed fiber, without washing it. As a general rule, a small amount of alum added to the dye bath answers the purpose of a mordant. The heterogeneous character of the wood prevents the dye from being absorbed evenly. As will be shown in the following discussion, this is an advantage rather than a detriment, so that no leveling agent is necessary.

General Scheme

A general method of procedure may be illustrated as follows: In an indefinite quantity of water, dissolve an amount of dye equal to three per cent of the weight of the fiber. Heat the solution nearly to boiling and add the fiber. Add about two per cent of alum (aluminum sulphate) based on the weight of the fiber. Digest hot for about one hour and let it cool. Remove the fiber and dry it (usually without washing) in a drying oven. These directions are to be taken in a very general sense. Changes in them, to suit the different dyes, will be suggested by the directions given by the dye manufacturers, by standard textbooks, and by experience.

The kinds of dyes which may be used are illustrated by the following list of a few of the many dyes we have found satisfactory: Alizarine cyanine green G extra, alizarine cyanine yellow, alizarine cyanine irisol, crocein scarlet 3 B, rhodamine B extra, sulphur blue, diamine brown, diamine rose, naphthol orange, beta naphthol yellow, flavopurpurine, alizarine tartrazine, chloramine brown. Obviously any desired color can be obtained.

It is to be understood that these colors have proven fast to light when tested by

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the laboratory method described above. Before attempting any commercial application, it would, of course, be wise to determine the permanency of the dyes which it is proposed to use. This information may be obtainable from the dye manufacturers, or it may be necessary to learn from experience. Attention is called to the fact that the color need not be perfectly fast to light to give satisfactory service. If a wall is evenly exposed, so that all parts of it fade at the same rate, the fading is not a serious defect. There is also the probability that the walls will be re-decorated every few years to suit the tastes of new occupants of the building.

There are a great many pure chemical compounds which have definite colors in and of themselves. A massive piece of such a compound will appear in its true color, irrespective of the viewpoint of the observer. However, most of the materials with which we are familiar are not simple substances, but are mixtures of several ingredients. This is particularly true of wall plaster. If the different ingredients have different colors, as is usually the case, then the color of the mixture will depend upon the relative amounts of the ingredients, the relative sizes and positions of the particles, and the viewpoint of the observer. A plaster which appears gray on casual observation may, on close inspection, be found to consist of a number of black specks embedded in a white matrix. If the black specks are large enough to be easily visible, then the plaster is no longer gray, but is a mottled black and white. It will be noted that the term "easily visible" defines the position of the observer. The mottled effect, which is pleasing to the eye, is obtained only when the black particles are uniformly distributed; if they are collected in large aggregates, the effect is blotchy and displeasing.

Mixing Colors

While fibers of one color only can be used, better effects can be obtained by the use of two or more different colors. In this way, the predominating color can be made more agreeable and satisfying by the use of supporting colors. Spots of the principal color should be distributed uniformly (but not in regular pattern) throughout the matrix. They should be large enough so that their identity can be distinguished without effect. Each spot should be set off by surrounding it with a number of small spots of one or more secondary colors. These should be so small that they cannot be distinguished except by close inspection. The effect of the whole can be improved by giving the surface a rough texture.

Of course, due care must be taken that only those colors are used together which harmonize well with each other.

Plasters colored by this method will have "life." By this it is meant that the color of the plaster is more or less dependent upon the position of the observer; the color changes as he moves. Suppose, as the simplest case, that a plaster contains fibers of two principal, but no secondary colors. When viewed from one direction, it is probable that one color would be reflected much more than the other and would become dominant. Viewed from another angle, the reverse might be the case. Close inspection would reveal the two colors equally. At a sufficient distance, the reflected colored lights would be superimposed, giving rise to an entirely different color, or even to gray if the original colors are complementary.

A similar live effect can be produced by a rough surface. The protuberances cast shadows on the depressions, and thus produce light and dark tints. The intensity and the apparent magnitude of these shadows depend upon the position of the observer, and seem to vary as he moves. The life of such a surface, and its pleasing effect, is dependent upon its texture.

The above statements form a brief outline of the principles underlying the manufacture of this type of colored plaster. It will be noted that the effect desired may be described as a "uniform lack of uniformity." It is desirable that the wood fiber shall not take up the dye evenly. The principal color can be made predominant either by using a large quantity of fiber or else by using a dye which will "bleed." For the secondary colors the fiber should be quite small and the dye fast to water, or, if the dye will bleed, the fiber may be replaced by sawdust.

Ready-Mixed Colored Plaster

The desired proportions of the different colored fibers are mixed with the calcined gypsum and other ingredients to form a gypsum wood-fibered plaster of the usual composition. This is shipped dry, mixed with lime putty and water, and applied in the usual way. Up to this point the only novelty in the manufacture of a colored plaster lies in the use of a dyed wood fiber instead of the naturally colored material. Of course care must be exercised in the selection of colors which will blend harmoniously, and in the admixture of the proper proportions of primary and secondary colors.

The desired texture of the finished surface may call for a variation in the quantity of fiber used. It will be recalled that commercial wood-fibered plaster contains about 1 per cent of fiber by weight. This is equivalent to about 15 per cent by volume. About 1 part of fiber to 1 of plaster, by volume, is the maximum amount which can be used if the surface is to be troweled smooth. If, however, a rough surface is desired, the quantity of fiber may be increased; 2 parts of fiber to 1 of plaster can be used by patting it into place.

A rough texture is produced by brushing the plaster just as it sets. This removes the gypsum from the surface and exposes the colored fibers. Differences in the quantity of fiber and in the method of brushing permit the production of a great variety of textures. We have developed three types of texture which are illustrative of variations obtainable. The "smooth finish" is obtained by the use of a plaster containing 0.3 to 1 part by volume of fiber to 1 part of plaster. The plaster is troweled to a smooth surface in the usual way. Since this surface is not brushed, and the fiber is not exposed, it is necessary to use dyes which will bleed rather profusely. Otherwise the color will not be sufficiently pronounced. Just before the plaster has set, it may be brushed with a fiber scrubbing brush, taking care that the marks made by the brush are all either horizontal or vertical. This produces an "organdie" finish. For the "tapestry" finish, we use 2 parts of fiber to 1 of plaster. This is patted into place but cannot be troweled. Just before the plaster sets it is stippled with a wire brush. The resultant surface is very rough and bears some resemblance to tapestry.

Removing Efflorescence

It was found that a slight efflorescence appeared during the drying of the plaster, which marred the brilliance of the colors. This was overcome by washing the plaster with soap and water. The soap can be applied just before the plaster is finally troweled down, or the plaster may be allowed to harden and dry before scrubbing it. A thick solution of strong laundry soap in hot water is recommended. Apparently the soap enters into chemical reaction with the lime in the plaster, forming a calcium resinate or similar gelatinous compound, which effectually closes the pores of the plaster and prevents further efflorescence.

This method of scrubbing the plaster with soap and water affords a housewife a means of brightening the walls whenever necessary.

No matter how pleasing the appearance of a wall may be, it is probable that a change in the decorative scheme will some time be desired. When this occurs, it is only necessary to remember that a colored wall plaster is essentially the same as any other wall plaster. It may be covered with another coat of plaster, either colored or white, or it may be painted or papered in the usual way.

In conclusion, it may be stated that a method has been developed for producing a colored wall plaster of any desired color or texture. Effects can be produced with this plaster which are not attainable with either paint or wall paper. A wall finished in this plaster can be washed when the colors become dull or soiled, or it can be redecorated in the same way as any other plastered wall.

Practical Chemistry for Lime and Cement Manufacturers

Metals of the Alkalies—The Calcium Family

By Richard K. Meade, M. S.
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THE METALS COMPRISING the calcium family are calcium, strontium and barium. All are quite similar to each other in chemical properties and all are of industrial importance. These elements are known as the *metals of the alkaline earths.* This is an old name and is derived from the fact that their oxides have an earthy appearance and are also strong alkalies. While the oxides of this group are not such strong alkalies as those of the sodium and potassium group, they are much stronger than those of the other heavy metals.

The metals of this group are all bivalent; that is, they displace two atoms of hydrogen, or combine with one atom of oxygen. They all form salts of somewhat similar properties. The oxides all unite directly with water to form hydroxides as explained below under calcium. All are silver white metals, of which calcium is the lightest and barium the heaviest. When thrown on water these metals all decompose the latter, just as do sodium and potassium, the reaction in this case of calcium being:

$$Ca+2H_2O=Ca(OH)_2+H_2$$

Of these metals, calcium alone is of any interest to lime and cement manufacturers, although small quantities of strontium are sometimes found in lime and cement, the amount rarely exceeding one-tenth of one per cent. Strontium salts are used in medicine, in sugar refining and in red signal lights and fireworks. Strontium occurs in nature chiefly as *celestite* or strontium sulphate, $SrSO_4$, but is sometimes found as *strontianite,* $SrCO_3$. Barium occurs chiefly as *barite,* or barium sulphate, $BaSO_4$. This mineral is more commonly called *barytes* or *heavy-spar.* Barium also occurs as *witherite,* or barium carbonate, $BaCO_3$. *Blanc Fixe* is precipitated barium sulphate. Barium di-oxide, BaO_2, is used extensively to prepare hydrogen peroxide, while the carbonate sulphate and chloride are extensively used in the paint and rubber industries.

Calcium

This metal is of the greatest interest to lime and cement manufacturers and the chemistry of these industries may be said to be the chemistry of calcium. Some space will, therefore, be devoted to this element and its chemical compounds.

Calcium is one of the most widely distributed of all the elements and excepting aluminum and iron is the most abundant of the metals. It exists chiefly in nature as calcium carbonate, $CaCO_3$, in the form of limestone, chalk, marl, shells, etc. *Dolomite* $CaMg(CO_3)_2$, is a double carbonate of lime and magnesia. Many rocks such as granite, sandstone, etc., contain small amounts of calcium in the form of calcium silicate, $CaSiO_3$. Calcium sulphate, $CaSO_4$, occurs in nature as *gypsum,* calcium phosphate, $Ca_3(O_4)_2$, as *apatite,* phosphate-rock, pebble-rock and in bones, and calcium fluoride, CaF_2, as *fluorspar.*

The metal calcium is not seen outside the chemical museum and laboratory although it has been proposed to use it in purifying steel. It is a silvery-white crystalline metal which can be cut, drawn into wire or rolled into sheets. It is a little harder than either lead or tin. It melts at 1,400° F. or a little above the melting point of magnesium. It is a little over one and a half times as heavy as water (Sp. gr. 1.55). It is a little heavier than magnesium and much lighter than aluminum.

When calcium is heated in air it burns brilliantly like magnesium (photographic flashlight powder is finely pulverized magnesium), but the flame is red. This red flame is characteristic of calcium and is made use of to detect calcium or its compounds in what is known as blow-pipe analysis. This form of analysis is used to detect and identify minerals. When calcium burns in air a curious phenomena occurs—the metal combines with both the oxygen and the nitrogen of the air, whereas when most substances burn they only combine with the oxygen and leave the nitrogen. As has been shown, calcium decomposes water forming calcium hydrate and, if a piece of calcium is left in the air, it becomes rapidly covered with a coating of calcium hydrate from the moisture in the air.

Calcium was discovered as an element by Sir Humphrey Davy, an Englishman and the inventor of the miner's safety lamp in 1908, but the German chemist, Bunsen, first prepared the metal in 1855. Calcium is prepared by passing an electric current through melted calcium chloride, when the latter is decomposed and the calcium collects at the cathode.

Calcium is one of the most chemically active of all the elements. As has been said, it is widely distributed in the mineral kingdom. Aside from its presence here, it occurs in the ashes of most plants, in bones, in seashells, in eggshells, and in most natural water.

Calcium Carbonate

Calcium carbonate, $CaCO_3$, occurs in nature in many forms. The mineral *calcite* or *Iceland-spar* is pure crystallized natural calcium carbonate. This mineral occurs crystallized in one of two forms, either in flat rhombohedrons or in pointed six-sided crystals. The former somewhat resemble a cube which has been slightly flattened and forced to one side, while the latter are best described by their common name "dog-tooth spar."

Limestone is a compact, indistinctly crystalline variety of calcium carbonate. *Chalk* and fresh-water *marl* are usually fine-grained, loose and earthly materials consisting largely of calcium carbonate. *Shell-marls* are masses of more or less broken and decomposed shells of marine fauna and occur principally in the United States in the lowlands bordering on the Atlantic Ocean and its estuaries.

Travertine is a massive limestone, either compact or porous, which has been deposited by the water of springs or streams along the courses of the latter. *Stalactites* and *stalagmites* are the icicle-like forms of calcium carbonate which occur in caves. The former hang from the ceiling, the latter project from the floor. Both are caused by the drip of water containing calcium carbonate in solution from the roof. *Marble* is a commercial term and is applied to granular crystalline limestones which take a high polish and have attractive colors.

Calcium carbonate is insoluble in pure water but appreciably soluble in water containg carbon dioxide. When such a solution is boiled the carbon dioxide is expelled and the calcium carbonate is deposited. (See a previous article on Water.)

When heated calcium carbonate is decomposed giving carbon dioxide and calcium oxide.

$$CaO+CO_2=CaCO_3$$
$$CaCO_3=CaO+CO_2 \text{ and}$$

It will be noted that this reaction is reversible and that calcium oxide and carbon dioxide unite to form calcium carbonate

and this latter reaction takes place at ordinary temperatures.

Lime or Calcium Oxide

The temperature at which decomposition takes place varies with the pressure. Thus, under a nearly complete vacuum calcium carbonate can be decomposed at 1100°F., while at atmospheric pressure the decomposition takes place at 1650°F. At a pressure of two atmospheres a temperature of about 1750° is required. This phenomenon is precisely similar to the evaporation of a liquid, where a vacuum reduces the boiling point and pressure raises it. The following figures as to the relation of pressure and the decomposition point of calcium carbonate are from the experiments of John Johnston.

Pressure Millimeters of Mercury*	Temperature °C.†
2.3	600
25	700
68	750
168	800
373	850
773	773
1490	1490

A fixed and definite quantity of heat is required to decompose calcium carbonate. This amounts to 813 British thermal units per pound of calcium carbonate decomposed or to 1450 B.t.u. per pound of calcium oxide formed. (1,845 B.t.u. per pound of carbon dioxide expelled). As one pound of coal will liberate 14,000 B.t.u. on burning, there are theoretically required only about 0.132 pounds of coal to burn one pound of limestone.

Pure Calcium Oxide

Pure calcium oxide may be made by heating calcite or Iceland-spar above 1650°F., as indicated above until all the carbon dioxide is driven off from the latter. Impure calcium oxide or lime results when limestone is so heated. The chemist, however, often uses the word "lime" in place of calcium oxide. Thus in expressing an analysis lime is often used where the chemist means calcium oxide because the term is better understood by the layman. Similarly, magnesia is used in place of magnesium oxide and potash and soda in place of potassium oxide and sodium oxide respectively.

Calcium oxide, is a white porous solid matter similar to lime in general appearance although lime is often colored by impurities such as iron oxide present in the limestone from which it is burned, whereas pure calcium oxide is white. It is infusible in any ordinary commercial flame such as the acetylene torch or oxy-hydrogen blow pipe, but may be melted and even made to boil in the electric arc. The melting point is usually placed at 4500°F. but such high temperature fusion points are largely approximations.

(To be continued)

*For inches of mercury multiply by 0.0394.

†For degrees Fahrenheit multiply by 1.8 and add 32.

Cement Industry in Canada

F. P. Jones, Managing Director of the Canada Cement Co., Talks on Government Owned Plants—Price Low Compared to Cost of Production

REGARDING THE PROPOSAL of the Ontario government to enter the manufacturing field and erect a plant to make cement, F. P. Jones, managing director of the Canada Cement Co., Ltd., gives some illuminating facts regarding the industry. He says:

"Canada can already produce more than double its requirements of cement. Last year the quantity of cement on the market was limited by a coal shortage, not by a cement shortage. The Canada Cement Co. had to lend the Dominion government coal last year to keep its buildings warm.

"Last year we sold cement in Canada at a lower price than in England or the United States. The duty on cement today is 8 cents per 100 pounds, or about 16 per cent ad valorem, and yet no one can import cement so that our prices cannot be much higher than those in the United States.

"Cement today is about 80 or 90 per cent higher in price than before the war. We think there are few commodities showing such a small increase. We are hopeful that as the cost of fuel, cotton sacks and other commodities comes down we will be able to steadily reduce our price and eventually get it down to at least close to the pre-war prices.

"That will come as soon as other reductions justify it, whether the Ontario government or anyone else builds a cement mill, and I am satisfied that before any cement mill can be built in Canada prices will be so low that a new mill will have great difficulty in earning interest on its capital and on working capital which it must have.

"It is evident the Ontario government figures the mill will cost about $3 per barrel to build. I doubt very much if they can build it at that figure at all. Even if they do they will have to have considerable working capital in addition to the $1,000,000 for the construction of the mill. The Canada Cement Co.'s mills stand on the books at $2.14 per barrel."

It may be of interest to readers of ROCK PRODUCTS to note that in the past 10 years no less than 15 cement plants in Ontario have gone into liquidation and are no longer in operation. One of them never turned a wheel.

At present there is a large stock of cement on hand in Canada. Some mills have as much as 250,000 barrels in storage. There will be no further shortage unless transportation becomes disorganized again and in such a case the government mill would be affected just as much as any other mill.

According to the annual report of Canada's largest producer, coal last year was 540 per cent more than in 1914 and labor advanced 145 per cent. The average price of all commodities entering into the manufacture advanced 196 per cent and the selling price advanced only 90 per cent. In order to pay dividends the company last year had to withdraw $500,000 from its reserve fund.

Discovery of Kaolin Deposits in Austria

THE EXISTING PARALYSIS of the porcelain industry in Austria, according to Consul Carol H. Foster, of Vienna, gives promise of being shortly removed because of the discovery of valuable deposits of kaolin recently reported. The clay is said to be plastic and very white and suitable for making the best varieties of electric porcelain with a fusing point of 1750 deg. C. Eighteen holes have been bored on an area of 20 acres and have indicated a deposit reported in some places to be more than 36 meters in depth. The engineer in charge of the development expects a production within six months of 300 tons a day of the best china clay, valued at about $60 a ton. It is planned to establish a refractory plant for treating the clay, using the Government plant at Wellersdoff, and to develop glass, textile and metal works in connection therewith.

Two companies, the Kamig Austrian Kaolin & Mining Co. (now transformed into a stock company) and the Schwertberg Kaolin Works, have begun exploiting deposits near Allerheiligen, are building large washing plants, and plan later to manufacture china and technical porcelain. Lower Austria also has some small kaolin deposits near Pochlarn and Aspang. The Styrian Kaolin & Quartz Sand Co. was organized a short time ago for exploiting Styrian kaolin.

Austria's supply of kaolin was formerly obtained from Bohemia and Germany.

Open Price Plan Defended

Practiced Legitimately, It is a Benefit to the Industry and to Society

THE OPEN-PRICE PLAN was defended as a means toward stabilizing conditions and preventing sudden and wide fluctuations, by Roy A. Cheney at a large meeting of manufacturers recently at Philadelphia, Pa. Mr. Cheney denied that the honest operation of the open-price plan would result in a combination to raise or maintain prices.

"The open-price plan in business or in industry, when operated correctly and truly as an open-price plan and nothing more, means simply and solely the telling or publishing of the prices of your product to those who are interested, in exchange for a knowledge of the prices of their product," said Mr. Cheney.

"It is absolutely unquestioned that men in business or industry seek to learn as much as they can regarding their competitors' lines and prices. Sometimes there is an open or frank exchange over the telephone or by mail between men who have become friends, but usually the desired information is sought and obtained in devious way and by kitchen-door methods. In every business where the open-price plan is not in operation the usual scramble for price information takes place.

"What is the result? In the first instance, the securing of information in these roundabout ways is expensive. In the second place, and the most dangerous, the information secured is often garbled, distorted, and in some cases absolutely untrue. The net result is that the seeker after information is misled to his damage and sometimes to the damage of an entire industry. And it is an absolute truth, that where a business or an industry suffers unjustifiable loss through lack of information or misinformation, an economic wrong has been committed.

"The economic danger resulting from lack of authentic price information has been recognized by our Government, and, in fact, by enlightened governments the world over. The results of this recognition are the governmental reports on commodities, and the recently instituted wireless report service giving daily the prices current in the main distributing centers of the country. All of this is simply the open-price plan on a national or governmental scale, instituted because producers composing a large majority of the people demand this information for the proper conduct of their business, and the Government, recognizing the economic value of it, grants the service.

"On the other hand, individual industries, feeling as acutely the need of like information, but not having a large enough representation of our population to warrant governmental aid, have set about gathering this information among themselves. The result is the open-price plan, first promulgated by the late Arthur J. Eddy.

"The first principle of the open-price plan to be grasped, remembered and practiced, is that all prices reported through a secretarial office must be prices that have been actually made and quoted in the ordinary conduct of business. In other words, the information given must relate to past transactions actually consummated. Prophecies and hopes should not and must not be tolerated, because they are dreams, and not facts, and it is upon facts alone that the open-price plan is based.

"A principle, equal in importance to the one just enunciated and one which must be impressed upon the members of an open-price organization, is that a member in joining such an association must know and feel that he remains in absolute control of his business policies; that he is bound in no way, morally, legally or financially to conform his prices or policies to the reported ones of any other member; that he is in no way bound or obligated to maintain the prices he has reported, but that he may be and, in fact, is free to change his prices as often and in whatever direction appeals to his business judgment. The only obligation that rests upon him is that he will report his prices and his changes in prices to his association office when he makes them.

"It is the opinion of economists, bankers and enlightened business men that wide, sharp and sudden change in prices is the curse of our modern economic life; that the recurrence of this 'business cycle,' as Harvard economists call it, is useless, wasteful, and the cause of needless loss to bankers and business men; that the cause of these wasteful fluctuations making up the business cycle is largely ignorance and misinformation, and that the remedy and the cure for them is a broader knowledge by every business man of the factors in his industry, both past and present. A knowledge of current prices is recognized as one potent factor and that is supplied by the open-price plan.

"Putting it in other words, a correct knowledge of prices will tend to stabilize conditions and prevent these sudden and wide fluctuations. We must remember, however, that a knowledge of prices or an exchange of prices will not prevent a liquidation where liquidation is due.

"The dangers to the public or the business man resulting from an open-price association are the same that result from any association, whether labor, business, political or financial. Any organization which is the result of a combination of factors results in power, and it is the correct use or abuse of that power which makes the organization useful or marks it as a danger to the community.

"The gravest danger to any association is the growth within it of a combination to fix and maintain prices. These combinations are so foolish and so useless that it is a wonder business men have not discarded them years ago. Besides the loss of good will and the danger of legal punishment, these combinations mean the breaking up of the association which tolerates them. They may last during a rising market, but in a decline they will always end in a row.

"So why run the risk of breaking up an organization, constructive in its work, and valuable to its members, for the temporary gains resulting from a price-fixing combination? It is as foolish as it is illegal. The honest operation of the open-price plan will not result in any such combination. It will not raise or maintain prices, and the secretary who permits such a combination to grow up within his organization, open-price or not, is simply paving the way for the disruption of his organization."

Chicago Men Negotiating for Nevada Gypsum Deposits

A GROUP of 28 Chicago financiers, including Foster C. Scott of Scott & Stitt, Chicago brokers, inspected a gypsum plant at Moapa, Nev., recently, according to a Los Angeles newspaper:

The White Star Plaster Co., a Los Angeles concern owns the gypsum mill and property at Moapa, and it is understood the Chicagoans contemplate purchasing an interest in the concern.

All of the machinery now used at Moapa was purchased in Los Angeles and practically all of the labor employed there, it is understood, also comes from this city.

John L. Scott, a member of the party, stated that Foster Scott, his brother, could not be reached, but admitted that the party "has experts working on the gypsum problem." The plant at Moapa, it is understood, represents an investment of $250,000 and is the only one operated on a gravity system in the United States.

Slate Production in 1920

Greatest Value in History of the Industry

THE VALUE OF THE SLATE sold by quarrymen in 1920, according to figures compiled by A. T. Coons of the United States Geological Survey, Department of the Interior, was $8,726,442, the largest value yet recorded for this material. This value, however, does not indicate any decided revival in the slate industry as a whole, for the quantity of roofing slate sold (396,230) squares) was only eight per cent more than in 1879, the year of the lowest recorded sales (367,857 squares), and more than 72 per cent less than in 1902, the year of the largest recorded sales (1,435,168 squares). The average value per square, however, was $3.35 in 1879, $3.45 in 1902, and $8.90 in 1920.

The total quantity of mill stock sold in 1920 was approximately 9,910,000 sq. ft., an increase of 33 per cent over the quantity sold in 1919, but 24 per cent less than that sold in 1913, the record year. The total value of the mill stock sold was $3,147,281, a gain of 77 per cent over the value of that sold in 1919.

The slate sold in 1920 was all produced at well-established quarries in Maine, Maryland, New York, Pennsylvania, Vermont, and Virginia. The following tables show the condition of the slate industry in 1919 and 1920 in the producing states and give the quantity and value sold for different uses.

Labor and Wages

The general industrial conditions in the slate industry in 1920 were seemingly somewhat better than in the three or four preceding years. Labor was very scarce until November, 1920. Wages were generally raised from 10 to 35 per cent during the year and for some work at certain quarries even to 100 per cent, though at some quarries wages were the same throughout the year and at others they were raised three times during the year, about 10 per cent each time. There were no general strikes. A few sporadic troubles, which closed quarries for a week to 10 days at a time, were settled by increases in wages. The outlook for better labor conditions in 1921 was said to be very promising. Prices advanced for all slate products from 10 to 30 per cent, or enough to cover advances in labor and coal. The prices of roofing slate were in general reduced during the last quarter of the year.

Demand Poor for Roofing Slate—Good for Mill Stock

Nearly all the producers reported that the demand for roofing slate was poor or fair, especially during the last three months of the year, and that the outlook for 1921 is not very promising.

The demand for mill stock was extremely good, and many orders could not be filled on account of labor and railroad conditions. Demand for mill stock for use in the electrical industry, which began to improve late in 1919, was very good until about November, 1920. The demand for blackboard and school slates, most of which are exported, was good throughout the year. Structural slate was also in good demand, but the poor demand for roofing slate in Eastern Pennsylvania is bringing about a scarcity of structural and blackboard slate, as the two kinds of material are so situated in the quarry that the roofing stock must be removed before the structural stock can be worked. The more extensive use of roofing slate will therefore promote more economical quarrying and so tend to reduce the cost of both roofing and structural slate.

Standardization of Structural Slate

The slate quarrymen realize more and more that much of the success of their business, especially in structural slate, lies in the standardization of the sizes of the products. The method of procedure usually followed has been to quarry and prepare structural slate in sizes specified by builders and architects. Therefore the lack of uniformity in design or size prevents the production of material in advance. This condition has led to enforced unemployment in mills and quarries and in serious delays to builders, as the slate quarries cannot always produce stock at the time orders are received. To improve these conditions the Structural Slate Co., of Pen Argyl, Pa., which represents various structural slate producers in the Pennsylvania district, has, through its Structural Service Bureau, proposed standard specifications for structural slate products and has issued illustrated pamphlets showing sizes and shapes of standard parts for structural work. It is hoped that the acceptance of these specifications by associations of architects and builders will aid materially in stabilizing the slate industry.

Slate Granules a Striking Feature

A feature of the slate industry which has been of much interest during the last four or five years is the use of crushed slate granules as a surfacer for prepared asphalt roofing. Besides the slate granules represented in the accompanying table, 26,167 short tons of stone other than slate, valued at $112,332, were sold for this purpose in 1919, and about 40,000 short tons, valued at $240,000, in 1920. This amount does not include stone crushed and used as a roofing gravel. The figures for New York and Pennsylvania,

Roofing Slate, Mill Stock,* Slate Granules, Etc., Sold in 1919 and 1920

Product		1919 Quantity	1919 Value	1919 Average Value Per Unit	1920 Quantity	1920 Value	1920 Average Value Per Unit	Percentage of Increase or Decrease 1920 Quantity	Percentage of Increase or Decrease 1920 Value
Roofing	squares	454,337	$3,085,957	$6.79	396,230	$3,524,658	$8.90	—12.8	+14.2
Approximate equivalent in short tons		153,000			134,000				
Electrical	square feet	1,302,034	607,796	.47	1,950,397	1,491,769	.76	+49.8	+145.4
Approximate equivalent in short tons		9,000			10,700				
Structural and sanitary	square feet	2,258,772	627,009	.28	2,593,563	916,216	.35	+14.8	+46.1
Approximate equivalent in short tons		17,000			19,500				
Grave vaults and covers	square feet	404,475	81,631	.20	477,239	130,795	.27	+18.0	+60.2
Approximate equivalent in short tons		5,800			6,800				
Blackboards and bulletin boards	square feet	1,845,687	304,251	.16	2,254,876	385,480	.17	+22.2	+26.7
Approximate equivalent in short tons		13,000			16,200				
Billiard table tops	square feet	349,018	107,471	.31	344,258	140,032	.41	— 1.4	+30.3
Approximate equivalent in short tons		2,500			2,500				
School slates	pieces	2,445,435	54,635	22.34†	4,302,390	82,989	19.29†	+75.9	+51.9
Approximate equivalent in square feet		1,306,000			2,290,000				
Approximate equivalent in short tons		2,200			4,000				
Granules	short tons	202,611	1,155,140	5.70	268,516	2,044,942	7.62	+32.5	+77.0
Other	(estimate) short tons	4,500	6,758		6,500	9,561			+41.5
Total (quantities approximate in short tons)		409,600	6,030,648		468,700	8,726,442		+14.4	+44.7

*In 1919 the total mill stock sold, including school slates, was approximately 7,466,000 square feet, valued at $1,782,793; in 1920 it was approximately 9,910,000 square feet, valued at $3,147,281. †Average value per thousand pieces.

however, include a small amount of slate "flour," used in the manufacture of plastic roofing slate and backing for rubber, linoleum, oilcloth and as a filler for asphalt.

The Prepared Roofing Association, through its secretary, has informed the Survey that in 1920 approximately 375,000 tons of slate or stone granules were used in the manufacture of grit surface roofing and asphalt shingles. A little over 50 per cent of this quantity was used for roll roofing and the remainder for shingles. About 30,000,000 squares of asphalt roofing were shipped in 1920, of which approximately 60 per cent was roll roofing, 20 per cent grit-surfaced roofing, and 20 per cent asphalt shingles. Slate granules have been used as a roofing surfacer for the last 10 or 15 years, but only during the war, when low-priced, easily applied roofing was in demand, did this use become very common. This roofing has therefore not been in use long enough to permit a comparison of its durability with that of regular roofing slate, which may be seen on buildings 50 to 75 years old in this country and over 300 years old in England and Wales.

Up to 1920 the granules used were obtained chiefly from the red and green slates of New York and Vermont. A small quantity, however, was obtained from colored slate from Utah and a "dark blue" slate from Lancaster County, Pa. In 1920 slate "flour" and granules were also produced at Albany and Lenhartsville, Berks County, Pa., and were reported respectively as "red" and "green" slate. According to reports, a large plant has been erected in Rutland County, Vermont, for quarrying and pulverizing purple slate to be used in the manufacture of a plastic composition to take the place of small sizes of natural slate used in the electrical industry. Besides other development work in the localities mentioned preparations for the erection of mills to produce slate and manufacture granules in 1921 have been reported at Jemison, Chilton County, Ala. (purple and green slate); Fairmont, Bartow County, Ga. (green slate); Cardiff, Harford County, Md. ("Black" slate); Tellico, Monroe County, Tenn. (green slate), and Esmont, Albermarle County, Va. ("black" slate).

Stone granules other than slate were obtained for use as roofing surfacer from deposits at Elsinore, Riverside County, Calif.; Marquette, Marquette County, Mich.; Iron Springs and Charmian, Adams County, Pa.; near Front Royal, Warren County, Va., and Dresser Junction, Polk County, Wis.

The stone at most, if not all, of these places is "greenstone" or altered diabase. Efforts are reported to have been made to use "dunite" or olivine rock and rock composed largely of epidote but the granules produced from these rocks were so extremely hard and sharp-edged that when rolled onto the asphaltic base they cut it too deeply. The greenstone or altered diabase is inferior to olivine and epidote in depth of color but is composed for the most part of softer minerals. A few inquiries have been received by the United States Geological Survey concerning the distribution of rocks of certain colors, regardless of their mineral composition, and in view of the expected large demand for all roofing materials after the present protracted curtailment of building, it will not be surprising if the varieties of stone used for roofing granules should increase considerably.

Thorough Investigation of Building Materials Proposed

Bureau of Standards to Study All Phases of Construction Question

By Bertram F. Linz
Washington Bureau, Rock Products

A FUND OF $50,000 is to be appropriated by Congress for the use of the Bureau of Standards in continuing and extending its investigations of structural materials. The tremendous shortage of homes which exist throughout the country, the 265 different building codes operative in as many cities, and the pressing need for improvement in construction materials and methods has resulted in Congress lending a sympathetic ear to the complaints that are pouring in upon Congress that the cost of houses is so great that people can afford neither to build nor buy them.

The bureau's need for the appropriation was presented to the House Appropriations Committee by Secretary of Commerce Hoover, Dr. S. W. Stratton, director of the bureau, and Franklin T. Miller, secretary for the Senate committee that inquired into the building situation.

"The housing and building situations generally have become very critical," said Dr. Stratton, in explaining the appropriation. "We are called upon for a vast amount of information as to the properties of material, types of construction and certain forms of standardization, which we are unable to do with our present funds, and it will be necessary to have an extension of those funds if we are to take the lead in this sort of thing and pave the way to better and simpler forms of building construction.

"It is pitiful to see the waste of money all over the country in ordinary buildings. The time is coming, and coming very rapidly, when we must pay more attention to the housing of the public, the quality of it, its lasting properties. Wood is fast disappearing, and the building of the future must be made of fireproof materials; it must be made more sanitary and more safe. We have paid a great deal of attention in this country to the things that are needed in heavy construction, office buildings and so on. They have been fairly well worked out, but the other buildings, which at the present time are more important, have been almost totally neglected, except through the work done by the associations of the producers of these materials. They are doing a good work, and of course we would co-operate with them, especially in working out some of the scientific data needed.

"For example, a few days ago a brick manufacturer came along, or rather a representative of the association, and presented a plan for laying out bricks which it was claimed saves 25 per cent of the material. It was more or less of a hollow wall. They wanted this laid up and tested for strength, wanted its fire-resisting properties tested, and a number of other things regarding it which had to be tested out before it could be allowed in any form in building construction."

The great need, the director pointed out, is of uniformity of building codes, a statement which was reiterated by Secretary Hoover, who said that uniformity would result in saving from 10 to 20 per cent of the entire cost of building construction in the country.

Changes in Prices of Chicago Paving Materials, 1920-21

BIDS WERE recently received by the city of Chicago for municipal paving work. The following table prepared by one of the municipal engineers and published in the Chicago "Tribune" gives the percentage of change of price of the various materials largely used in paving work:

Crushed limestone	2% increase
Gravel and sand	5% decrease
Cement	17% decrease
Asphalt	7% decrease
Flux oil	40% decrease
Asphalt sand	14% increase
Road oil	20% decrease
Granite blocks	4% increase

The committee voted to buy the 1921 supply, $530 000 worth, of crushed limestone, gravel, sand, cement, asphalt, flux oil, road oil, paving brick, creosote and granite blocks on the bids submitted.

Theory of Surface Areas Applied Sand-Lime Brick Making*

Proportioning Sand and Lime by Scientific Methods

By Robert Marshall
Canadian Inspection and Testing Laboratories, Toronto, Ont.

MOST MANUFACTURERS OF SAND-LIME bricks have experimented on their own initiative with possibly two objects in view. (1) To improve the quality of their bricks. (2) To decrease the cost of the manufactured product. It is also probably a fact that when you get together to compare results as you do at convention time that there is not complete unanimity with regard to results; that is, your own results are not applicable to the products of other members of the convention.

I have noted also from your annual reports that certain facts relative to steam pressure, length of time in kettle, moulding pressure, mixing, and the preparation of lime have been partially standardized, and at the same time I have noted that difference of opinion still exist as to the amount of lime that can be economically used and at the same time maintain the standard of excellence of sand-lime bricks.

When I had the honor last year of presenting a paper to your association I was at a disadvantage in not knowing what might be of vital interest to you. However, in the discussion which followed last year I received an idea which I thought might be presented to your convention with profit.

Function of the Lime

In this discussion Mr. Schilling contended that the purpose of the lime was to fill the voids in the sand. All lines of argument are against this contention.

I have recently made some experiments which show that the void in a dry sample packed runs between 29 and 31 per cent. If the same sample has 5 per cent of water added and packed in the same way the void goes up to 39 per cent. Then as water is added the void is reduced. Identically the same condition exists when 6 per cent of lime is mixed with the sand, and the minimum percentage of void which I have been able to calculate when the sand is under a pressure of 5000 lbs. per sq. in. is 18 per cent. I think this is a direct answer to Mr. Schilling's argument.

Old theories have a tendency of dying a lingering and lamented death and the theory of voids in concrete construction is giving a pretty good example of the above statement. We have been taught that the cement filled the voids in the sand and the resulting mortar filled the void in the stone. However, in the process of using this method some very contrary results were obtained and while seeking causes of the poor results some interesting studies were pursued which I think have also a very direct bearing on the manufacture of sand-lime bricks.

In papers that have been presented to the American Society of Testing Materials the following points have been established:

(1) That grading or surface area has a very definite relationship to the strength of mortars.

(2) That the amount of water is a factor of the amount of cement used.

It seems a very logical deduction to make that the factors which influence the strength of concrete should also influence the strength of any combinations of materials mixed to give an even distribution of the bonding material. The proportions commonly used in sand-lime brick making, namely, 6 to 10 per cent, cannot possibly be anything else than a surface area coating to the sand particles. I therefore believe in presenting this point of view to you again that a study of your own sand and using this as a basis will produce results which will be of practical benefit to your business.

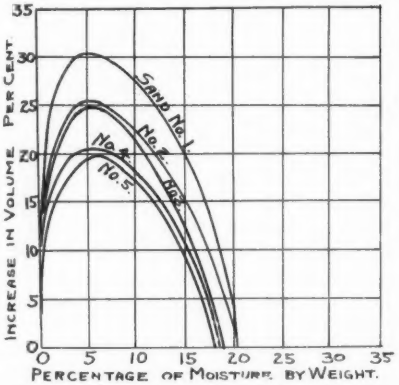

Fig. 1. Curves showing bulking of sands as the water is increased

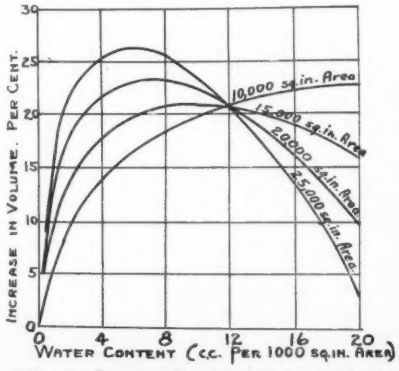

Fig. 2. Curves showing water content for sands of different surface area

Effect of Water Content

One very interesting result of the discussion of papers before the A. S. T. M. has been the investigation of sands from the point of view of the bulk when water is added. Below are given two curves from a discussion of L. N. Edwards before the A. S. T. M. Fig. 1 shows the bulking of sands as the water is increased. Fig. 2 shows the water content for sands for different surface area. It will be noted that in each case the maximum bulking volume is the same.

The second point established that the ratio of cement to water is a direct function of the strength is a question that I leave with the members of this association to determine. I recognize the fact that in sand-lime bricks the limiting water content will be that which will bond the brick together so that it can be handled and piled on cars. Also due consideration has been given to the fact that the bond in sand-lime bricks is not so much a chemical function of the water as in concrete. I do believe, however, that the ratio of water will have a direct bearing on the plasticity and covering quality of the lime and it will offer a very fertile field for investigation.

That the coating of the surface area of the sand particles is the theoretical basic consideration of your industry seems to me to be borne out by the fact that the improvements in your methods of making bricks have in all cases improved the covering of the sand particles.

Take lime. You are convinced that every improvement you have made in hydrating has improved the quality of the bricks and the reason is that it gave a finer lime powder, also that it was free from unhydrated lumps, all of which would improve its spreading quality.

Also take the question of mixing. At

*Paper presented at the annual convention of the Sand-Lime Brick Association, Dayton, Ohio, April 26 and 27, 1921.

first you used a pug mill, then later found better results from wet pan, and now I am told you propose to use a tube mill. These changes, which have meant successive improvements, can be shown to have resulted in a more thorough covering of lime to each particle of sand and that the increase in strength has been due mainly to this factor.

You ask me how this method is to be applied to your industry and I give the following outline:

1. Carefully prospect your pit, particularly the face, to get a sample which is characteristic. If a thorough investigation is intended at least a ton would be essential.

2. A screen analysis is then made to determine the percentages of the different sizes. There is a definite opening diameter for each size of particles.

3. Count out the number of particles on each size of screen over No. 100 such as the number per ounce. From this you find the square area by assuming each particle is spherical and of the diameter of the opening of the screen through which it has passed.

4. Then calculate the area per pound or 100 lbs. or per ton, depending on the unit in use.

Present Concrete Practice

In the research already made on concrete the fine particles passing the No. 100 sieve are calculated as fillers and 5 per cent of cement is added over the amount necessary to coat the surface of the sand particles to account for the cement lost with this dust.

The surface area method of proportioning concrete has passed the preliminary experimental state; it is now being used very successfully in the concrete, being placed by the Hydro-Electric Commission of Ontario at Niagara Falls and has proved very economical and satisfactory.

I believe also that there is a good field for investigation in the sand-lime brick industry along similar lines; probably some of your results that are not understood from a sieve analysis may be understood when the area to be covered is calculated.

Unfortunately I have not the facilities to test out this idea of proportioning, but I understand this association has facilities offered to it for carrying on such work. If I were to perform these experiments myself I would experiment on the following lines:

1. Determine what effect moisture has in the compressibility of sand-lime mixtures. Moisture affects the density of the sand; also the denser the sand, the stronger the bricks. It would appear therefore that there is a certain percentage of moisture that admits of handling which gives a compact brick.

2. Determine the percentage by weight of lime which is sufficient to cover the sand particles. This would have to be undertaken by varying the lime content in a series of tests of the same sand, then with a number of other sands, the best results to be determined by compression tests.

This paper is presented in the hope that it may open up a new line of investigation.

Suppression of Bond Issues in Indiana

CONSTRUCTION men in Indiana are much concerned in a new policy of the State Board of Tax Commissioners which will result in reducing the amount of public construction being started this year. The state board has adopted a policy of rigid suppression of bond issue proposals. John J. Brown, a member of the board, has stated that the disinclination of the board to authorize any except absolutely necessary issues has met with the approval of the Governor. He said the board believes that as long as construction prices are so high and the prices of commodities which provide money for the paying off of the issues are so low, the board will go easy in approving bond issue petitions. Issues bearing more than 5 per cent interest must be presented to the board for approval or rejection before they may be floated. Issues of 5 per cent may be protested by taxpayers and the state board will hold hearings to determine whether they should be sold. Virtually all public construction is dependent on action of the state board.

California Cement Manufacturer Gets Cut in Freight Rates

THE CALIFORNIA RAILROAD COMMISSION recently reduced by 20 cents a ton the charges for transporting by rail from the quarries, lime rock used in the manufacture of cement. A rate of 90 cents a ton for transporting the rock from Flint, Calif., on the American River, to Tolenas, Solano County, was held to be unreasonable by the commission in its decision on the complaint of the Pacific Portland Cement Co. against the Southern Pacific and the Cement, Tolenas and Tidewater Railroad.

Commissioner H. D. Loveland heard the "cement case." Finding the 70-cent rate reasonable for the service given by the Southern Pacific, Commissioner Loveland, in commenting on the cement company's predicament, says:

"This is a matter of desirability of geographical location and one which a regulatory body should not be required to relieve."

Quoting from a number of interstate commerce decisions sustaining this point of view, the commissioner says:

"It may be that one cement plant, on account of labor or housing conditions, availability of supplies or other reasons, cannot operate as cheaply as a competitor, yet for these reasons alone the carrier could not consistently undertake to equalize cost of distribution of finished product."

Sand and Gravel Production in 1920 Was 10 Per Cent Better Than 1919

THOUGH MANY PRODUCERS reported that their output had been curtailed from 10 to 30 per cent on account of inability to get railroad cars, the total quantity of sand and gravel produced in 1920 was nearly 78,000,000 tons, or about 7,000,000 tons more than in 1919. The total value increased from about $46,000,000 to more than $62,000,000. The production of building sand increased nearly 4,000,000 tons, and the average price per ton the country over rose from 56 to 66 cents. The output of molding sand increased more than 1,000,000 tons and the value more than $3,000,000. Glass sand, which is rather high-priced, rose from an average of $1.97 a ton in 1919 to $2.20. The following table includes preliminary estimates for 1920 made by L. M. Beach, United States Geological Survey.

Sand and gravel produced in the United States, 1918–1920.

Year.	Glass sand.		Molding sand.		Building sand.	
	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.
1918	2,172,887	$4,209,728	4,910,178	$5,121,865	19,686,885	$9,772,556
1919	1,827,409	3,593,371	3,774,612	4,153,990	21,969,736	12,296,664
1920	2,144,000	4,722,000	4,890,000	7,473,000	25,943,000	17,052,000

Year.	Other sand.		Gravel.		Total.	
	Quantity (short tons).	Value.	Quantity (short ton).	Value.	Quantity (short tons).	Value.
1918	6,349,870	$5,259,620	28,704,606	$13,563,310	61,824,426	$37,927,079
1919	8,397,979	6,345,654	34,606,671	19,561,877	70,576,407	45,951,556
1920	9,361,000	8,546,000	35,549,000	24,901,000	77,887,000	62,694,000

National Lime Association Convention

The Third Annual Convention of the National Lime Association and the Nineteenth Annual Meeting of Lime Manufacturers, the Most Notable in the History of the Organization, Will Be Held in New York City, June 15 to 17, 1921

THE convention will be held in the Junior Ballroom on the second floor, Hotel Commodore, Grand Central Terminal.

Exhibits

The foyer of the Convention room will be occupied by exhibits of the National Association and of the Eastern Bureau. The former will include the plaster and stucco panels as exhibited at the Own-Your-Home Expositions. The Eastern Bureau will feature the high points of their work in a special section of the exhibit.

Registration and Badges

A full registration of all persons attending the Convention is desired, and a booth for this purpose will be open in the foyer throughout the sessions.

Discussions

Although no formal discussion periods are listed on the program, the aim is to make a special allowance of time for each speaker, so that there will be opportunity for discussion following his formal presentation. Remember that the discussion may be the most valuable part of the program, and every person should feel free to take part in this phase of the program.

Noon Luncheons

Complimentary luncheons to all those attending the Convention will be provided each noon as scheduled in the program. These should help keep the crowd together and add to the good fellowship of the gathering. No charge for luncheons.

The Banquet

Please take particular note of the banquet on Wednesday evening at 6:30 o'clock. Reservation of tickets must be made by noon of that date. Price $4.00. On sale at registration booth in foyer. The Entertainment Committee has arranged a series of special features of entertainment, including speakers, orchestral music, songs, and stunts.

PROGRAM

All Schedules on Daylight Saving Time

Monday, June 13

1:00 P.M. *Meeting of Special Budget Committee*

Tuesday, June 14

10:00 A.M. *Meeting of Board of Directors*

Wednesday, June 15

Lime Production Problems

10:00 A.M. *Assembly and Roll Call of Member Companies*
Representatives are invited to make comments on the status and outlook of the lime industry in their home sections

10:30 A.M. *Introductory Remarks on the Convention Program*
President Charles Warner

10:40 A.M. *Kiln Efficiency*
Some New Features in Lime Kiln Construction
Richard K. Meade, Chemical and Industrial Engineer, Baltimore, Md.

11:15 A.M. *Chemical Control, the Key to Kiln Efficiency*
W. D. Mount, Mechanical and Chemical Engineer, Lynchburg, Va.

12:00 M. *The Fine Art of Lime Burning: As Exemplified at Rockland*
George B. Wood, President and General Manager, Rockland and Rockport Lime Corporation, Rockland, Maine

12:40 P.M. *Appointment of Convention Committees*
Guest Reception
Nominations of Officers
Resolutions

12:45 P.M. *Complimentary Buffet Luncheon. All Together*

1:30 P.M. *Luncheon Address*
Standardization—Government -Research and Industrial Development
Dr. S. W. Stratton, Director, U. S. Bureau of Standards, Washington, D. C.

2:15 P.M. *Problems to be Considered in Changing a Quarry from Hand Methods to Steamshovel Methods*
Irving Warner, Plant Manager, Charles Warner Co., Wilmington, Delaware

3:00 P.M. *Social Service and Labor Efficiency*
Relations of Banking Institutions to Social Service
Willard A. Eckman, Welfare Specialist, United Security Life Insurance and Trust Co., Philadelphia, Pa.

3:30 P.M. *Social Service as Applied to the Lime Industry*
E. J. Heimerdinger, Assistant to the President, Louisville Cement Co., Louisville, Ky.

4:00 P.M. *Adjournment for District Group Conferences*

6:30 P.M. *Banquet*
A rousing social time with good music, songs and stunts by lime producers. Program arranged by Entertainment Committee

Thursday, June 16

Extending the Use of Lime

9:00 A.M. *Symposium on the Special Properties and Merits of Lump Lime*
Speakers to be announced

9:45 A.M. *Wet Mixed Lime Mortar*
A Chapter of Successful Experience
W. C. Hay, Vice-President and General Manager, Blue Diamond Plaster Co., Los Angeles, California.

10:15 A.M. *Is the Central Mixing Plant the Next Step in Handling Lime and Concrete Mortars?*
Discussion

10:45 A.M. *An Architect's View of Lime and Its Use*
D. Knickerbacker Boyd, Architect and Manager of the Structural Service Bureau, Philadelphia, Pa.

11:30 A.M. *Reaching the Public*
Association Organization and the Central Office Mailing List
Edith J. Munsell, Editorial Manager, National Lime Association

11:50 A.M. *Building Up and Management of District Mailing Lists*
A. P. McCallie, Sales Manager, Kelley Island Lime & Transport Co., Cleveland, Ohio

12:15 P.M. *Convention Photograph*

12:45 P.M. *Complimentary Luncheon (Seated). All Together*

1:30 P.M. *Luncheon Address*
The Business Outlook
Francis H. Sisson, Vice-President, Guaranty Trust Co., New York City

2:30 P.M. *Delivering the Goods: The Dealers' Viewpoint*
Tom Wright, Manager, Building Materials Corporation, formerly Secretary of New York State Building Supply Dealers Association, Rochester, N. Y.

3:00 P.M. *The Dependence of Modern Industry on Research*
Arthur D. Little, President, Arthur D. Little & Co., Consulting Industrial Chemists, Cambridge, Mass.

3:45 P.M. *Why is a Soil Chemist? or Getting Facts about Lime in the Soil*
Dr. W. H. MacIntire, Soil Chemist, Agricultural Experiment Station, Knoxville, Tenn.

4:15 P.M. *Lime and Lime: The Plasticimeter Demonstrated*
Warren E. Emley, U. S. Bureau of Standards, Washington, D. C.

Friday, June 17

The Brass Tacks of Association Work

9:00 A.M. *Report of Secretary—Summary of the Year's Work*
Elmer O. Fippin, General Manager

9:30 A.M. *What of the Future?*
President Charles Warner, President, Charles Warner Co., Wilmington, Delaware

9:50 A.M. *Report of Audit Committee*
H. B. Matthews, Mississippi Lime & Material Co., Alton, Ill.
H. A. Gawthrop, Merion Lime & Stone Co., Norristown, Pa.

Technical Department Accomplishments and Plans —Brief Review

10:00 A.M. *Construction*, L. H. Hart, Manager

10:20 A.M. *Chemistry*, Dr. M. E, Holmes, Manager
10:40 A.M. *Agriculture*, J. A. Slipher, Assistant Manager
11:00 A.M. *District Bureau Work*
First-Hand Experience
Henry M. Camp, Director, Eastern Bureau
11:15 A.M. *The Ways of Lime in a Big City*
T. B. Shertzer, Field Engineer, Eastern Bureau
11:30 A.M. *Agricultural Lime from the New England Slant*
R. C. Parker, Agronomist, Eastern Bureau
11:45 A.M. *Some Chapters from the Experience of a One Man Field Staff*
C. O. Dowdell, Field Engineer, Central Bureau, St. Louis, Mo.
12:00 N. *Inside Glimpses, Inside Out, on Promoting Lime in Construction*
H. L. Brickell, Field Representative, Construction Department
12:15 P. M. *Discussion*
12:30 P.M. *Complimentary Buffet Luncheon. All Together Again*
2:00 P.M. *Action on Amendment to By-Laws*
2:15 P.M. *Report of Standing Committees*
Cost Accounting, A. D. Warner, Jr.
Tariff, George B. Wood
2:30 P.M. *Budget for 1921-22 by Group Minimums*
3:00 P.M. *Fixing the Annual Tonnage Dues for 1921-22*
3:30 P.M. *Election of Officers. Report on Selection of Directors*
3:45 P.M. *New Business*
4:15 P.M. *Report of Committee on Resolutions*
4:30 P.M. *Meeting of New Board of Directors*

Freight Rate Situation to Date

Comparison of Mileage Scales in Michigan and Wisconsin

AS THIS ISSUE of Rock Products goes to press the results of the meeting between producers and railway executives at Washington, D. C., are not known. Producers attending this meeting were agreed that nothing less than a 40-per cent decrease in the present rates would be even considered. Even then many rates would be too high for traffic to move.

The Washington meeting was confined to road-building materials, including brick and asphalt. Lumber interests and others in the general construction field are to have separate conferences. A great deal of data was prepared by the sand and gravel interests and they are determined to carry their case to the Interstate Commerce Commission if the railways do not voluntarily meet the critical situation of the industry.

In connection with the sand and gravel case the following summary of local freight rate cases was prepared by E. Brooker, traffic manager of the Pennsylvania Sand and Gravel Producers' Association:

Montana

The Montana Commission has reduced the rates on sand, gravel and crushed stone to the level of rates in effect prior to Ex Parte 74.

This action eliminates the 25-per cent increase authorized at that time and applies until November 20, 1921.

New England

Special Sixth Section Permission No. 52806 has been granted the New York, New Haven & Hartford R. R. to reduce the rates on sand, gravel and crushed stone to become effective about May 15, 1921.

Generally speaking the reduction is about two cents per 100 lbs. or 40 cents per ton. The reductions have been made with a view of inducing the business to move, from established sand and gravel pits and rock crushing plants rather than force those using the material to either forego the construction of roads or buildings this year, or obtain their supplies from new plants established through the use of the capital which, in the interest of the New Haven and New England, might be believed to be better invested if put in the form of materials purchased at the established points of origin.

New York

The State Commission in Case 7714 has eliminated the 40-per cent increase in freight rates authorized under Ex Parte 74. This becomes effective April 30, 1921, and applies to rates on sand, gravel, stone and slag.

Michigan

Michigan Commission has issued an order effective May 20, 1921, reducing rates on sand and gravel to the following basis:

5 miles	.55	100 miles	$1.15
10 miles	.60	115 miles	1.20
15 miles	.65	130 miles	1.25
20 miles	.70	145 miles	1.30
25 miles	.75	165 miles	1.35
30 miles	.80	185 miles	1.40
40 miles	.85	205 miles	1.45
50 miles	.90	225 miles	1.50
60 miles	.95	250 miles	1.55
70 miles	1.00	275 miles	1.60
80 miles	1.05	300 miles	1.65
90 miles	1.10		

The above represents an average decrease of about 22 per cent.

Wisconsin

The State Commission by Order in Case R-2760 has promulgated the following scale to apply on sand, gravel and crushed stone:

5 miles	46c	55 miles	76c
10 miles	50c	60 miles	80c
15 miles	52c	65 miles	82c
20 miles	56c	70 miles	84c
25 miles	58c	75 miles	86c
30 miles	62c	80 miles	88c
35 miles	64c	85 miles	90c
40 miles	68c	90 miles	92c
45 miles	70c	95 miles	94c
50 miles	74c	100 miles	98c

New Jersey

A press dispatch from Trenton, N. J., of May 26 says: Deciding that the 40 per cent increase in freight rates granted the railroads July 29 is unjust and unreasonable, in so far as it applies to shipments of sand, gravel and broken stone within the state. The Public Utility Commission today handed down a report sanctioning an increase of 15 per cent instead of 40 per cent. over the previously existing rates.

Under an agreement reached by the railroads, the 25 per cent freight charge exacted between August 2 last and the present time in excess of the rate allowed by the commission, will be refunded.

Pennsylvania

Complaint heard, awaiting decision.

West Virginia

Complaint has been prepared for filing.

In addition to the information given above by Mr. Brooker, it is our understanding that Louisiana, Oklahoma and Arkansas have also removed the freight rate increases on sand, gravel and crushed stone, made effective by the Interstate Commerce Commission Order Ex Parte 74.

The comparison of the two mileage scales in the case of Wisconsin and Michigan brings out the discrepancies that exist in these local railway commission orders, which will certainly mean trouble for the industry later on.

Decision in the Pennsylvania case is awaited with much interest. The scale proposed by the producers in this case was printed in Rock Products of February 26, 1921.

Washington State to Locate Sand and Gravel Deposits

AN EXAMINATION of the country between Rosalia and Dayton, Wash., along the Inland Empire Highway, to locate road-building material, principally sand and gravel for concrete work, will begin June 20, according to the Washington State Geologist, Dr. Solon Shedd.

The examination was requested by the State Highway Department for the purpose of locating new gravel deposits. The work will be under the supervision of D. A. Scott, with O. P. Jenkins, Assistant Professor of Geology, in charge of the road party.

Commodity Rates Urged for Sand, Gravel and Crushed Stone

Vice-President of the A. T. & S. F. R. R. on Freight Rates

IN A STATEMENT filed before the senate committee on Interstate Commerce, which is conducting an investigation into the railroad situation, Mr. Edward Chambers, vice-president of the Atchison, Topeka and Santa Fe Railroad, said:

"An examination of the records of the Interstate Commerce Commission and other government and public sources, to my mind, shows:

"1. That the present diminished volume of traffic has not resulted from the increased rates on commodities under order Ex Parte 74, by which the Interstate Commerce Commission undertook to provide adequate revenue for the carriers as required by the Transportation Act.

"2. That the present rates as a whole are not excessive under existing conditions.

"Transportation is the most important factor in the industrial and commercial life of the country, and in the public interest great care should be exercised to see that it is sufficient for our commercial and industrial needs.

"Reductions in rates to bring about necessary readjustments are going on daily throughout the country by dealings directly between shippers and railroad traffic men. While many complaints and statements of a general character have been issued regarding the effect of higher freight rates, they are, however, insignificant in number compared with those adjustments which have been made effective as a result of direct negotiations between carriers and shippers.

"Approximately 85 per cent of the commercial tonnage of the railroads of the United States moves under commodity rates. These commodity rates are made, as stated before, to fit commercial conditions on the basis of what the commodity can reasonably and fairly bear in distribution; that is to say, on the value of the service to shippers. The great staples, such as grain, lumber, fruits and vegetables, live stock and coal, move to markets almost entirely under commodity rates.

"These rates are the most important to the communities, to the states, and to the commercial activity of the nation. While distance hauled is an important factor in the making of these rates, it cannot always be controlling if we are to continue the development of the country as a whole. Adjustment of commodity rates to extend sources of supply and develop markets often requires the same rate from the more distant producing point to market as is charged from a nearer source of supply.

"In fixing a rate on a commodity so that it may reach certain markets often consideration must be given to what that source of supply can afford to pay in the way of freight rate in excess of the rate paid by a nearer source of supply shipping to the same market.

"I have already mentioned that 85 per cent of the commercial tonnage on the railroads in the United States is moved under commodity rates, and of this more than three-fourths consists of comparatively few commodity groups. This is mentioned to impress upon the committee the fact that any general reduction in the rates on the important commodities moving would mean a considerable volume of revenue taken from the carriers."

Commenting on the rates charged for the movement of sand, gravel and crushed rock, Mr. Chambers said:

"The movement of these commodities may properly be classed as local, or they are hauled but short distances and at very low rates, comparatively, and are produced everywhere. In the later years, and since drayage charges have increased so much, the cost of distribution in the city of destination is often greater than the freight charge for the main-line haul. The hauls are usually over a single line. The general conditions surrounding the production and distribution compel minimum rates. There are two terminal services to each shipment, and often one is in a large city where the switching is expensive and must be absorbed out of the main-line rate.

"Modifications in Ex Parte 74 rates are being made daily throughout the country for one reason or another, the shipper dealing directly with the carrier. While we hear some complaints of excessive rates, when you consider that the annual movement of these commodities is approximately 100 million tons, scattered all over the country, the complaints we hear are insignificant compared to the tonnage moving, and there must be thousands of transactions daily throughout the country where these commodities are involved. As these commodities cannot be moved at the class rates, a commodity rate must be provided for every carload movement, and new commodity rates are therefore being constantly published.

"The average haul in the different sections and the average charge are:

	Average Haul	Average Rate
Eastern District	65 miles	73c per ton
Southern District	68 miles	90c per ton
Western District	60 miles	74c per ton

"The number of tons of clay, sand, gravel and crushed rock hauled in each quarter of 1920, during the last of which quarters the advanced rates were in effect, were as follows:

First Quarter—15,766,002 tons
Second Quarter—25,967,455 tons
Third Quarter—30,548,043 tons
Fourth Quarter—26,232,054 tons

"The drayage charge at Washington for hauling sand, gravel and crushed rock within the city limits is 50 cents per ton for the first mile or less and 10 cents per ton for each additional quarter of a mile, the drayage charge for a mile and a half being as high as the freight rate for the average rail haul in the eastern district.

"Cement, brick and plaster move in large volume and generally for comparatively short distances. Manufacturing plants are scattered throughout the whole country; many are close to large consuming markets. There is a substantial movement now and has been right along."

High Freight Rates and Crushed Stone

A CIRCULAR recently issued by the Illinois Crushed Stone Association shows in graphic form how the production of crushed stone has fallen off with each general increase in freight rates. The following points from the circular are of interest:

"Freight rates on crushed stone and similar materials now average some 120 per cent higher than they were four years ago. The reduced output of these commodities has resulted in a net decrease in revenue to the railroads. The reduced output of crushed stone is not confined to any one locality. The output of sand, gravel and other branches of the stone industry has suffered a similar loss. Crushed stone, sand and gravel are the lowest grade commodities transported by the railroads; they are entitled to lower freight rates.

"Increased freight rates have shortened the railroad shipping radius of modern stone crushing plants, and promoted the operation of small local stone and gravel deposits. The tonnage under old freight rates was large and regular. Restore the old rates and the old time prosperity.

"Increased freight rates and reduced output also add to the cost of producing and marketing these commodities. Crushed stone moves in open-top cars during spring and summer months, when railroad operating cost is lowest. Then releases equipment for winter coal trade.

"There is no risk in transportation; no damage to equipment; no special service; no loss or damage claims."

Editorial Comment

The Lime Convention

For the first time in the history of the lime industry a really effective organization is now assembled to seize upon all the opportunities available to live manufacturers of a very essential staple commodity. The field for development and progress is so very large that it has taken some time and effort to really grasp its possibilities and map out a course. This the able staff of the National Lime Association under Elmer O. Fippin, general manager, has succeeded in doing and deserves the hearty support of all lime manufacturers.

Possibly no other industry has ever received such severe set-backs and survived as the lime industry has received through the use of rival commodities in the building construction field. Nevertheless the industry has continued and progressed and could not be discouraged. A product with real merit can not be kept down by any force of circumstances.

Today the lime industry of America stands at the threshold of the greatest period of prosperity in its history. But to take full advantage of the opportunities offered there must be the highest type of cooperative effort. Such effort will be directed not only toward promoting the use of lime in old and new fields, but toward improving and standardizing the *quality* of the lime itself.

The lime industry is in something the same position as the Portland cement industry at the time the cement industry started its intensive promotional work. One simply can not promote a commodity on a wholesale scale, of which there are 57 varieties and qualities. The problem of standardizing lime is infinitely more difficult than standardizing Portland cement, because its uses are so many and so varied. Nevertheless the problem must be squarely faced. And for the good of the lime industry and its future as a whole a manufacturer of lime must eventually accept his particular lime for the particular uses it is best fitted to serve, and then confine his sales to that field.

Mineral Aggregates?

As this issue of Rock Products goes to press the producers of sand, gravel, crushed stone and slag are again thrown together in a common cause—i. e., convincing the railway executives at Washington that freight rates on these materials must be reduced if the industries are to live and prosper. Evidently there has not been much preliminary effort made to harmonize the views of the representatives of the three interests involved, and it remains to be seen how much nearer they are to "amalgamating" these interests now than they were last winter.

Apparently the joint conference with the railway executives was arranged for through the efforts of representatives of both the crushed stone and sand and gravel interests, but these efforts appear to have been more or less independent and one would invite trouble if he were to give either party the major credit.

While it is true that there are some fundamental differences in the interests of these three national associations in the mineral aggregate field, it is certainly unfortunate, to say the least, that there can not be more harmony of effort in matters of such mutual interest.

Mileage Scales

There appears to be considerable misunderstanding over E. Brooker's and the Pennsylvania Sand and Gravel Producers' Association's advocacy of a mileage scale of rates on sand and gravel. In his letter published in Rock Products, May 21, 1921, President C. H. Markham, of the Illinois Central R. R., referred to Mr. Brooker's scale as "an inflexible" mileage scale. Many sand and gravel producers seem to have somewhat the same impression.

Mr. Brooker has informed the editor that nothing could be more erroneous. His scale is proposed as a maximum scale to serve as a basis of scientific rate making. It is fully expected that this scale would have to be modified to meet local competitive conditions, or peculiar market conditions.

The contention of Mr. Brooker and those who advocate a uniform mileage scale of rates is that the producers of sand and gravel *must* have something tangible to work with in their fight for lower and more equitable rates. The possible knocking off of the 40 per cent advance of last summer is only a step. Even with this done the producers still have to contend with the 20 cents per ton advance made during the war and with 5 and 15 per cent advances just prior to the war.

These are no small handicaps as the producers in New York State, where the 40 per cent advance has never been applied, have found out. But still further reduction of rates without a thorough revision of all the rates is improbable and if a revision of rates is necessary, some basis for new rates must be developed.

Mr. Brooker and his associates believe that the railways oppose mileage scales because by so doing they create dissension in the ranks of producers and thus postpone any rate revision or readjustment. This has been their experience in Pennsylvania.

The mileage scale of rates was at first as strenuously opposed in Pennsylvania as anywhere, but Mr. Brooker was able to convince producers there that a mileage scale was the most fair and equitable, and that its advocacy would offer a better chance for a reduction in rates than any other stand they could take.

Accident Prevention

Handling Men

By W. Dean Keefer, Safety Engineer, National Safety Council

HANDLING MEN is like selling goods, and we should never make a "sale" without giving thought to future relations. A sale is made only when the salesman and the customer *agree* upon a certain thing. Therefore, the foreman should work for continuous agreement and try to handle every transaction in such a way that the workmen will want to do business with them for years to come.

Sincerity and Fairness

Sincerity is another powerful factor in handling men. Use judgment in making promises and, above all, never make a promise you cannot carry out. A frank and truthful explanation in case of misunderstanding will do much more to create good feeling than will weak excuses and half-apologies.

Handling men demands a spirit of fairness. Favoritism may cause trouble. A square deal and a just consideration for every man on the job will result in cooperation among workmen; if these do not prevail, there is sure to be dissension and strife.

Developing Men

Developing men should be one of the most pleasant features of a foreman's work, and he should never object to the transfer or promotion of an excellent man. On the other hand, he should pride himself on his ability to develop good men and try always to have men ready for better positions when the opportunity presents itself. If a man has failed, it may be a good plan to give him a chance on some other job. Nearly everyone is good for some particular work, and if you can arouse a man's interest, develop his pride and pleasure in production, you may do much toward making a firm friend and a steady employe.

It is often of importance to make a workman feel that the foreman has complete confidence in him and that he believes the workman can properly perform the work for which he has been selected. When a man knows that you believe in his ability and expect him to make good, he is likely to "discover" himself and succeed simply because of the confidence you have shown.

Many workmen never fully understand their work, and prefer to quit before the foreman discovers their ignorance. Surely something is wrong where this happens. Perhaps it is because the foreman attempts to "break in" his new men. Some horses and other animals can be handled only after they are broken in, but men can be handled successfully only when they are properly taught and reasoned with.

(To be continued)

The Foreman's Place in Accident Prevention

By C. W. Price, General Manager of the National Safety Council

IN MANY member plants of the National Safety Council departmental meetings of workmen conducted by the foreman once a month have proved most valuable in keeping up interest and enthusiasm in safety. These meetings give the foreman an opportunity to place himself on record as to what he is willing to do to protect his men, and what they should do. The workmen should also be encouraged to talk, and a friendly get-together spirit should be fostered.

Monthly meetings of foremen offer a valuable means of keeping safety uppermost. The main discussion usually centers around the accident experience of the past month. In this way a splendid opportunity is given the foremen to compare notes, to circulate and discuss blueprints and photographs of guards, copies of bulletins and posters, and outlines of successful schemes to reach the workmen. The superintendent and safety supervisor, if present, should not monopolize the time, but should attempt to advise with and assist the foremen in every way possible. It is a meeting of foremen and for foremen, so he should raise and discuss the subject from which he and his men will get the most benefit. Information of value may be obtained in learning what other plants and other foremen are doing.

An old shop man said the other day: "Some foremen baby safety work—they handle it just like an old woman would run a blacksmith shop. They really don't believe in safety. They haven't waked up to the fact that keeping their men from being injured, keeping their men on the job is a part of efficiency. Such a foreman never gets his men to take safety seriously.

"But a foreman in dead earnest about the safety of his men—a foreman doing everything in his power, day by day, to protect his men—never yet failed to get his men with him and to lead them out of dangerous places into safety.

"The foreman always sets the pace."

The Foreman's Place in Accident Prevention—Summary

1. *Why foremen are interested in safety:*

(a) Accidents decrease production and increase costs.

2. *Foreman the determining factor:*

(a) The workmen's attitude toward safety depends absolutely on the attitude of the foreman.

3. *Qualifications of a safe foreman:*

(a) He must believe in safety.

(b) He must be sincerely interested in the welfare of his men.

(c) He must be a leader capable of winning the confidence of his men.

(d) He must be informed on safeguards and safe practices.

(e) He must have backbone.

(f) He must be square with his men and show appreciation of their efforts.

4. *What a foreman can do:*

(a) A foreman can interest his men in safety by studying their jobs and giving specific directions as to the safe methods of work.

(b) He can start new men in the right direction by showing them that everyone in the shop is pulling together for safety.

(c) He should understand and present safety to the workmen as a business proposition.

(d) He should know every dangerous place or practice in his department.

(e) He should be responsible for safeguarding and should act promptly.

(f) He should see that tools and machines are kept in proper repair.

(g) He should insist on the care of slight injuries.

(h) The success of Workmen's Inspection Committees depends wholly on the foreman's support.

What Is It Worth to You?

To have all of the available Accident Prevention data at your finger tips—to secure a thoroughly developed system of organized Safety effort—to have all of the experimental element of prevention work eliminated for you?

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National Safety Council

Co-operative Non-Commercial

168 North Michigan Avenue, Chicago, Ill.

New Machinery and Equipment

Flexible Pipe Joint

TAKING out sand and gravel by suction dredge methods is becoming more and more in use every day. Twenty years ago in the sand and gravel business it was practically unknown. Today there is such a number of them that they are too numerous to mention, scattered throughout the United States and Canada. It is generally known that by conveying with the assistance of water, sand and gravel can be moved much cheaper from the pit to the cars, cheaper than it can be moved by any other method.

In the equipment used in hydraulic suction methods, it is very necessary to use a long pipeline, 100 ft. or more. These pipes have to be connected with a flexible connection. The usual method, up to the time the Berry Flexible Joint was invented, was to use rubber.

These joints take the place of this temporary method to hold the pipes together. With rubber sleeves, the cost is considerable, and it is of considerable expense to maintain them efficiently, as they wear out very rapidly. All this trouble is eliminated by the use of the Berry Flexible Joint, and they will outwear a number of these rubber sleeves.

These joints have been in operation for two years or more, and they are practical in every respect. The cost of conveying material through the pipe has been reduced considerably by the use of these joints.

There are two classes of joints, one of steel plates, fabricated, made of plate steel from ¼ in. to ½ in. thick, welded so that the weld does not come in contact with the material when it is flowing through the joint. There is a long lipped ring on the inside attached to the metal section, which is inserted in the female or bell section, so that when the pressure is on, the lips of the ring are sealed against the inside of this bell section, and the higher the pressure the tighter it becomes.

They are fitted with a patented locking, that, by the simple turning of this ring one or two inches in the slot, the joint is held together, and by the simple method of putting a bolt behind the ring to prevent it from coming back. This method of putting two pipes together is very unique, and can be done almost instantly.

Another feature of the Berry flexible joint is that it will take an expansion and contraction movement, at the same time taking an angular movement, this being the only joint ever made that will do this and hold pressure. The joint is different in every way from the so-called ball joint, especially in the respect that we do not have metal to metal to hold pressure, therefore, this joint is not a ball joint, but a flexible joint.

The rubber-lipped ring will outwear the metal itself, as it is made to resist wear and tear and withstand a great deal of use.

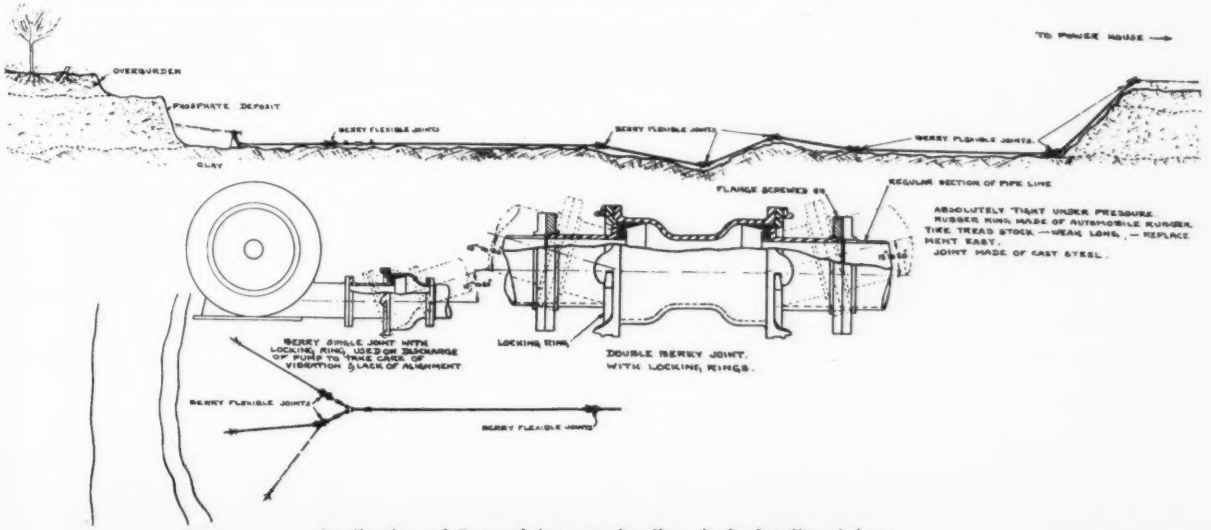
New Du-Pont Non-Freezing Dynamite

IN EXCAVATION work as a general thing the propagated method of blasting has been preferred because thereby is saved the time of priming all boreholes in the line of the shot and the time of wiring up the charges. However, a propagated shot requires the use of straight N. G. dynamite, and because it freezes and chills at a comparatively high temperature it has been possible to use it successfully for propagated ditch blasts, especially in the North, only during the five warm months of the year.

But now the discovery has been made by the laboratories of one of the powder makers of a formula for making a low freezing straight N. G. dynamite. It is anticipated that the use of this new explosive will extend the period during which propagated blasting may be successfully done in eight or nine months of the year.

As everybody knows, February is a cold month in northern Minnesota. In order to test the new dynamite some of it was used on February 21 on a ditch that was being blasted by the St. Louis County Engineer. The dynamite had been stored all winter in a Duluth magazine in the original unopened cases. Ordinary straight dynamite would have been frozen solid under the circumstances, but when taken from the box this low freezing dynamite was soft and in perfect condition for immediate use in spite of the fact that the temperature a week previously had been 18 degrees below zero, and there had been no weather intervening that would have caused thawing had the dynamite been frozen. It was loaded into wet, cold soil in bore holes drilled through 24 inches of frozen ground. The temperature of air and water at the time was about 30 degrees above zero.

The shot propagated perfectly and a ditch 9 ft. wide and 2 ft. deep resulted.


TO POWER HOUSE
OVERBURDEN
PHOSPHATE DEPOSIT
CLAY
BERRY FLEXIBLE JOINTS
BERRY FLEXIBLE JOINTS
BERRY FLEXIBLE JOINTS
FLANGE SCREWED ON
REGULAR SECTION OF PIPE LINE
ABSOLUTELY TIGHT UNDER PRESSURE. RUBBER RING, MADE OF AUTOMOBILE RUBBER TIRE TREAD STOCK — WEAR LONG, — REPLACE MENT EASY. JOINT MADE OF CAST STEEL.
BERRY SINGLE JOINT WITH LOCKING RING, USED ON DISCHARGE OF PUMP TO TAKE CARE OF VIBRATION & LACK OF ALIGNMENT
LOCKING RING
DOUBLE BERRY JOINT WITH LOCKING RINGS.
BERRY FLEXIBLE JOINTS
BERRY FLEXIBLE JOINTS

Application of Berry joints to pipe lines in hydraulic mining

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.00	1.50	1.50	1.50	
Buffalo, N. Y.			1.30 per net ton, all sizes			
Burlington, Vt.	**1.00**		**2.50**	**2.00**	**2.00**	
Chaumont, N. Y.	1.75	1.75	1.75	1.50	1.50	1.50
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	
Coldwater, N. Y.			1.50 per net ton, all sizes			
Eastern New York	.90	1.80	1.70	1.60	1.60	1.50
Eastern Penna.	1.00		1 85	1.85	1.85	1.85
Munns, N. Y.	1.00		Other sizes 1.50			
Walford, Pa.	1.40	1.60	1.75	1.75	1.60	1.60
Western New York	.70	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alden, Ia.	.80@1.00	.80@1.00	1.50	1.45		
Alton, Ill.	2.00		1.50	1.50		
Bettendorf, Ia.			All sizes, 2.00 cu. yd. f.o.b. quarry			
Brillion, Wis.	1.00		1.20	1.00	1.00	
Buffalo, Ia.	1.00	1.35	1.45	1.25	1.35	1.35
Chicago, Ill.	1.20	1.60	1.20	1.20	1.20	1.20
Columbia, Ill.	**2.15**	**1.90**	**2.00**	**2.00**	**1.90**	**1.90**
Davenport, Ia.	**1.50•**	**1.50•**	**1.50•**	**1.50•**		
Dundas, Ont.	**1.00**	**1.50**	**1.50**	**1.50**	**1.25**	**1.20**
Eden and Knowles, Wis.	**1.30**	**1.30**	**1.30**	**1.30**	**1.30**	
Greencastle, Ind.	1.75	1.35	1.25	1.20	1.20	1.20
Illinois, Southern	1.75	1.60	1.60	1.50	1.60	
Kokomo, Ind.	1.10	1.25	1.25	1.10	1.10	1.10
Krause or Columbia, Ill.	**1.80**	**1.30**	**1.50**	**1.40**	**1.30**	**1.30**
Lannon, Wis.	**1.00**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**
Marblehead and Brillion, Wis.	**1.10**		**1.20**	**1.10**	**1.10**	
Montrose, Ia.	**1.35**	**1.75**	**1.75@1.85**	**1.75**	**1.65@1.75**	
Oshkosh, Wis.			**1.40 per ton, all sizes**			
River Rouge, Mich.	1.50	1.65	1.65	1.50	1.50	1.50
St. Louis, Mo.	**.60**	**1.60**				
Sheboygan, Wis.	1.25	1.25	1.25	1.25	1.25	1.25
Stolle, Ill. (I. C. R. R.)	1.75	1.60	1.60	1.50	1.50	1.50
Stone City, Ia.	.80		1.50	1.40	1.30	
Toronto, Canad	1.90	2.40	2.40	2.40	2.15	2.10
SOUTHERN:			These prices include 90c freight			
Cartersville, Ga.		1.85	1.60	1.60	1.60	
Chico, Texas		1.00	1.50	1.50	1.25	1.10@1.25
Columbia, S. C.	**1.00@1.25**	**3.50**	**3.50**	**3.50**		
El Paso, Tex.	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	
Fort Springs, W. Va.	1.40	1.60	1.75	1.75	1.45	
Ladds, Ga.	1.75	1.75	1.75	2.00	2.00	
New Braunfels, Tex.	.60	1.50	1.50	1.25	1.25	1.25
Portland, Ga.	.60@ .75		All other sizes 1.60@1.75			
WESTERN:						
Atchison, Kans.	.50	1.10	1.10	1.10	1.10	1.10
Blue Springs and Wymore, Neb.	.20	1.65	1.65	1.60@1.65	1.45@1.50	1.40
Cape Girardeau, Mo.	1.50		1.50	1.50	1.25	
Kansas City, Mo.	1.00	2.00	2.00	2.00	2.00	2.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Baltimore, Md.	1.25	2.50	2.35	2.25	2.00@2.25	2.00
Bernardsville, N. J.	**2.00**	**2.20**	**2.00**	**1.80**	**1.50**	
Branford, Conn.	.80	1.95	1.80	1.60	1.40	
Bound Brook, N. J.	2.00	2.30	2.00	1.75	1.75	
Dresser Jct., Wis.	1.00	2.45	2.45	2.30	2.00	
Duluth, Minn.	.75@1.00	2.25	1.90@2.00	1.40@1.50	1.40@1.50	1.50
Dwight Station, Calif.			.75@1.00—all sizes			
E. Summit, N. J.	2.10	2.35	2.15	1.75	1.75	
Eastern Mass.	.60	1.95	1.75	1.50	1.50	1.50
Eastern Penna.	1.60	2.25	1.95	1.80	1.80	1.75
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60@1.00	1.60@1.80	1.60@1.80	1.40@1.50	1.20@1.30	
Oakland, Calif.	1.10	1.10	1.10	1.10	1.10	1.10
Richmond, Calif.	.50•		1.75•	1.50•	1.50•	
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Springfield, N. J.	2.15	2.35	2.15	2.00	1.85	1.75
Westfield, Mass.	.60	1.35	1.30	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Ableman, Wis.	1.60		1.30	1.50	1.20	
Alexandria Bay, N. Y.	1.60		1.30	1.50	1.20	
Baltimore, Md.—Gneiss	1.00	2.75	2.40	2.20	2.10	1.75
Berlin, Wis.	1.60		1.40	1.50	1.30	
Columbia, S. C.—Granite	.75		2.75	2.50	2.35	
Dell Rapids, S. D.	1.00		2.10	2.10	2.10	
Dundas, Ont.—Flint	1.10	1.10	1.10	1.10	1.10	1.10
Eastern Penna.—Sandstone	1.20	2.00	2.00	1.70	1.70	1.70
Eastern Penna.—Quartzite	.90	1.70	1.55	1.20	1.20	1.10
Holton, Ga.—Granite	.40		2.50	2.25	2.25	2.00
Lohrville, Wis.	1.60		1.30	1.50	1.20	
Los Angeles, Cal.—Granite		1.25@1.50	1.15@1.40	1.15@1.40		
Macon, Ga.—Granite	.50		2.50	2.25	2.00	2.00
Middlebrook, Mo.—Granite	3.50@4.00			2.00@2.25		1.25@1.75
Sioux Falls, S. D.	1.00		2.00	2.10	2.00	
Red Granite, Wis.	1.60		1.30	1.50	1.20	
Stockbridge, Ga.—Granite	.50	2 00	1.90	1.75	1.75	
Utley, Wis.	1.60		1.30	1.50	1.20	

•Cubic yard. †Agrl. lime. ||R. R ballast. §Flux ‡Rip-rap. a 3-inch and less.

Agricultural Limestone

EASTERN:

Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.50; bulk 2.75

Coldwater, N. Y.—Analysis, 56.77% $CaCO_3$, 41.74% $MgCO_3$, 70% thru 200 mesh, 95% thru 50 mesh, sacks 4.00; bulk 3.00

Grove City, Pa. — Analysis, 94.75% $CaCO_3$, 1.20% $MgCO_3$ — 70% thru 100 mesh; 80 lb. ppr., 5.50; bulk 4.50

Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$, 5.25% $MgCO_3$; sacks, 4.50; bulk 2.75

New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.50; bulk 3.00

Syracuse, N. Y. — Analysis, 90% carbonates—50% thru 100 mesh, 90% thru 50 mesh; sacks, 3.50; bulk 2.75

Texas, Md.—Analysis, 58.02% $CaCO_3$, 37.3% $MgCO_3$—50% thru 50 mesh; bags, 4.25; bulk 2.50

Walford, Pa. — 50% thru 100 mesh, 60% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk 3.00

West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$ — 90% thru 100 mesh; paper bags, 6.25—90% thru 50 mesh; paper bags, 5.25; bulk 3.25

West Stockbridge, Mass.—Analysis, 95% combined carbonates; 33% thru 200 mesh, 66% thru 100 mesh, 100% thru 20 mesh; sacks 5.25@5.50; bulk 3.25

Williamsport, Pa. — Analysis, 88-90% $CaCO_3$, 3-4% $MgCO_3$—50% thru 50 mesh; paper, 5.50; bulk 4.00

CENTRAL:

Alden, Ia.—Analysis, 99.16% $CaCO_3$.... .80

Alton, Ill. — Analysis, 96% $CaCO_3$, 0.3% $MgCO_3$—50% thru 4 mesh..... 4.50

Bedford, Ind. — Analysis, equivalent 98.5% $CaCO_3$—90% thru 100 mesh.. 1.60@2.00

Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk 2.50

Cape Girardeau, Mo.—Analysis, 90% $CaCO_3$, .044% $MgCO_3$—50% thru 4 mesh 1.50

Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$—90% thru 4 mesh.... 1.50

Columbia, Ill., near East St. Louis—½-in. down ..... 1.25@1.80

Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh..... 1.80@3.80

Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$,, 20.69% $MgCO_3$—50% thru 50 mesh 1.25

Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh..... 2.00

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$—90% thru 50 mesh..... 2.00

Marblehead, O.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$—52.4% thru 100 mesh, 59% thru 50 mesh, 100% thru 10 mesh; sacks, 5.25; bulk..... 3.00

Limestone screenings; bulk..... 1.50

McCook, Ill.—Analysis, 54.10% $CaCO_3$, 45.04% $MgCO_3$—100% thru ¼-in. sieve, 78.12% thru No. 10, 53.29% thru No. 20, 38.14% thru No. 30, 34.86% thru No. 50, 22% thru 100 1.50

Milltown, Ind.—Analysis, 91.59% $CaCO_3$, 4.87% $MgCO_3$ — 24% thru 200 mesh, 33.6% thru 100 mesh, 40% thru 50 mesh, 50% thru 40 mesh, 70% thru 20 mesh..... 1.65

Mitchell, Ind.—50% thru 100 mesh..... 2.00

Montrose, Ia.—90% thru 100 mesh..... 1,25

Ohio (different points), 20% thru 100 mesh; bulk ..... 1.50@1.75

Piqua, O. — Analysis, 82.8% $CaCO_3$, 8.2% $MgCO_3$; neutralizing power in terms of calcium carbonate, 95.3%—50% thru 100 mesh..... 3.25@5.00

50% thru 50 mesh..... 1.75@2.00

Ridgeville, Ind.—Analysis, 98% $CaCO_3$ 100% thru 4 mesh..... 1.75

River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk..... .80@1.40

Spring Valley, O. — Analysis 95.92% $CaCO_3$, 2.15% $MgCO_3$; 100% thru 10 mesh, bulk 3.00

Stolle, Ill., near East St. Louis on I. C. R. R. — Thru ½-in. mesh — Analysis, 89.61% to 89.91% $CaCO_3$, 3.82% $MgCO_3$ 1.75

Stone City, Ia.—Analysis, 98% $CaCO_3$ —90% thru 50 mesh ..... .80

(Continued on next page.)

Agricultural Limestone

(Continued from preceding page.)

Toledo, O.—Analysis, 52.72% $CaCO_3$, 43% $MgCO_3$—20% thru 100 mesh, 30% thru 50 mesh, 80% thru 100 mesh, 100% thru 5/32 screen..... 1.80
Whitehill, Ill.—Analysis, 97.12% $CaCO_3$, 2.50% $MgCO_3$—90% thru 100 mesh 5.00
50% thru 50 mesh..... 2.00
Yellow Springs, O.—Analysis, 96.08% $CaCO_3$, .63% $MgCO_3$—32% thru 100 mesh, 58% thru 50 mesh, 99% thru 10 mesh; sacks, 8.25; bulk..... 5.25

SOUTHERN:

Blowers, Fla.—Analysis, 98% combined carbonates—75% thru 200 mesh..... 5.00
Cartersville, Ga.—Analysis, 96% combined carbonates—pulverized limestone ..... 1.75@2.00
Claremont, Va. (Marlime)—Analysis, 90% $CaCO_3$, 2% $MgCO_3$—90% thru 50 mesh; bulk 3.50
Dittlinger, Tex.—Analysis, 99.09% $CaCO_3$, .04% $MgCO_3$—90% thru 100 mesh ..... 2.00@3.00
90% thru 4 mesh ..... 1.00@2.00
Grovania, Ga.—Analysis, 95% $CaCO_3$, no $MgCO_3$—50% thru 100 mesh..... 2.50
Hopkinsville, Ky.—Analysis, 94.6 to 98.1% $CaCO_3$; bulk 2.00
Knoxville, Tenn.—Pulverized 2.50
90% thru 100 mesh..... 2.00
90% thru 50 mesh..... 1.50
Ladds, Ga.—Pulverized limestone..... 2.50
Linnville Falls, N. C.—Analysis,, 53% $CaCO_3$; 42% $MgCO_3$—50% thru 100 mesh; sacks, 4.50; bulk..... 3.00
Memphis, Jct., Ky—Analysis, 95.31% $CaCO_3$, 1.12% $MgCO_3$; average price. ⅛ in. down 2.00
Mascot, Tenn.—Analysis 52% $CaCO_3$, 38% $MgCO_3$.
80% thru 100 mesh..... 3.00
All thru 10 mesh..... 2.50
80% thru 200 mesh..... 5.00
Paper bags, $1.50 extra per ton; burlap, $2.00 extra per ton.
Maxwell, Va. 2.50
Mountville, Va.—Analysis, 76.6% $CaCO_3$, 22.83% $MgCO_3$—100% thru 20 mesh; 100 lb. ppr., 7.00; bulk.... 5.00
Ocala, Fla.—Analysis, 98% $CaCO_3$—75% thru 200 mesh..... 4.50

WESTERN:

Colton, Calif.—Analysis, 95% $CaCO_3$, 1½% $MgCO_3$—all to pass 14 mesh; bags 5.00; bulk..... 3.50
Sacks, 15c extra, returnable.
Garnett, Okla.—Analysis, 86% $CaCO_3$, 50% thru 4 mesh ..... .50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk..... 2.00
Terminus, Calif.—Analysis, 96.2% $CaCO_3$, .04% $MgCO_3$—60% thru 200 mesh, 90% thru 100 mesh, 95% thru 50 mesh, 100% thru 4 mesh; sacks, 6.00; bulk 5.25
Tulsa, Okla.—90% thru 4 mesh..... .50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:

Beach City, O.—Washed and screened 3.00
Berkeley Springs, W. Va..... 2.50
Cedarville and South Vineland, N. J..... 2.00
Cheshire, Mass. ..... 5.00@7.00
Columbus, Ohio ..... 2.50@3.00
Gray Summit, Mo..... 2.50@4.00
Hancock, Md.—Damp ..... 2.50@3.50
Klondike and Pacific, Mo..... 2.50@3.00
Mapleton, Pa.—Dry 2.75
Glass, damp 2.25
Massillon, Ohio 3.50
Millington, Ill. 1.75
Mineral Ridge, Ohio 3.00
Montoursville, Pa.—Green, washed..... 2.00@2.25
Morgantown, W. Va..... 3.00@3.25
Oregon, Ill.—Large contracts..... 1.75
Ottawa, Ill. ..... 2.00@2.25
Pittsburgh, Pa.—Dry, 4.00; damp..... 3.00
Rockwood, Mich. 3.25
St. Marys, Pa.—Green 2.75
Thavers, Pa.—Washed ..... 2.00@2.50
Utica, Ill. ..... 1.75@2.25

FOUNDRY SAND:

Ableman, Wis.—Brass molding and molding fine 3.00
Albany, N. Y.—Glass and sand blast.. 2.00@7.00
Core ..... 1.40@2.50
Furnace lining ..... 2.50@3.00
Molding fine, coarse and brass..... 2.00@2.25
Allentown, Pa.—Core ..... 1.50@1.75
Molding coarse ..... 1.50@1.75
Arenzville, Ill.—Molding fine..... 1.50@1.75
Beach City, O.—Core, washed and screened ..... 2.00@2.50
Furnace lining ..... 2.50@3.00
Molding fine and coarse..... 2.25@2.50
Bowmantown, Pa.—Core ..... 1.35@1.50
Molding, coarse ..... 1.80@2.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Attica, N. Y.	**.75**	**.75**	**.75**	**1.00**	**1.00**	**1.00**
Buffalo, N. Y.	1.10	.95	.85	.85	.85	.85
Erie, Pa.		1.00		1.65		1.75
Farmingdale, N. J.	.48	.48	1.75	1.75	1.50	
Hartford, Conn.	**.90**		**1.25**	**1.15**	**1.15**	**1.15**
Leeds Junction, Me.		.60@ .75	2.00	1.75	1.65	1.50
Ludlow, Mass.	**.75•**	**.75•**	**1.70**		**1.50•**	**1.50•**
Philadelphia, Pa.	.75	.75		1.65	1.50	
Pittsburgh, Pa.		1.30	1.30	1.30	.85	.85
Portland, Maine		.50@ .60		1.50		1.35
Texas, Md.		1.00		Pure white sand, 1.50		
Washington, D. C.	**.75**	**.75**	**2.00**	**1.40**	**1.20**	**1.20**
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.50		1.00		.90@1.00
Attica and Covington, Ind.	.90	.90	.90	1.00	1.00	1.00
Barton, Wis.	.60	.60	.70	.70	.70	.70
Beloit, Wis.		.60	.60		.60	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, O., and vicinity....	.65	.60	.85	.85	.85	.85
Columbus, O.	.90	.90@1.25	1.25	.90@1.25	.90@1.25	.90@1.25
Des Moines, Ia.	.90	.65	1.60	1.60	1.60	1.60
		25% gravel, .90; 50% gravel, 1.15				
Detroit, Mich.	.65	.65	.95	.95	.95	.95
Earlestead (Flint), Mich.	.70		60-40 sieves, .85; Pebbles, .95			
Eau Claire, Wis.	.50	.50	1.00@1.25	1.00	1.00	
Elgin, Ill.		.80	1.00	.80	.80	.80
Elkhart Lake, Wis.	.70	.58	.90	.90	.72	.72
Grand Rapids, Mich.		.55		.90	.85	.85
Greenville, Mechanicsburg, O...	.80	.70	.80	1.00	.85	.80
Hamilton, O.		.90			.90	
Hawarden, Ia.		.70			1.60	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Le Mars, and Doon, Ia.		.90		1.80		
Libertyville, Ill.		.75		.75	.75	
Lincoln, Neb.		Sand .40, sand and gravel .80, drained for shipment				
Mason City, Ia.	.90	.80	1.90	1.80	1.70	1.65
Milwaukee, Wis.	1.30	1.30	1.40	1.40	1.40	1.40
Minneapolis, Minn.	.50	.50	1.50	1.50	1.50	1.50
Moline, Ill.	.70	.70	1.20	1.20	1.10	1.10
Oxford, Mich.		.25		.60	.50	.50
St. Louis, Mo., f. o. b. cars....	1.60	1.65	1.80	1.60		1.55
Summit Grove, Clinton, Ind.....	.90	.90	.90	.90	1.00	1.00
Terre Haute, Ind.	1.00@1.25	1.00	1.25	1.25	.90@1.25	.90@1.25
Winnipeg, Man.	1.90	1.90		3.25		2.85
Winona, Minn.	.70	.60	2.00	1.75	1.50	1.25
Yorkville, Moronts, Oregon and Sheridan, Ill.	.70@ .80	.70@ .80	.80@ .90	.70@ .80	.70@ .80	.70
SOUTHERN:						
Alexandria, La.	.60@ .90					1.65@1.85
Charleston, W. Va.			Sand 1.40—Gravel 1.50			
Ft. Worth, Tex.	**2.00@2.25•**	**2.00@2.25•**	**2.75@3.00•**	**2.75@3.00•**	**2.75@3.00•**	
Greenville, Miss.		1.10				1.00
Jedburg, Mo.		1.05	1.20	1.00	1.00	.95
Knoxville, Tenn.	1.15	1.15		2.15	1.95	1.75
Lake Weir, Fla.		**.75**				
Macon, Ga.		.75@1.00				
Memphis, Tenn.	**1.40**	**1.40**	**1.50**			**1.50**
N. Martinsville, W. Va.		1.30		1.40		1.00
New Orleans, La.	**1.00**		**1.75**		**1.25**	
Pine Bluff, Ark.	1.25	.92	Washed gravel, all sizes, 2.30			
Roseland, La.				1.25		
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.		(Kaw River sand, car lots, .75 per ton, Missouri River, .85)				
Niles, Calif.	1.00	1.00	1.40	1.00	1.00	1.00
Pueblo, Colo.	1.25•	1.00•			1.50•	
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.50•	1.50•	2.00•	1.50•		1.50•

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
Attica, Covington, Silverwood, Ind., and Palestine, Ill.	**.75**	**.75**	**.75**	**.75**	**.75**	**.75**
Boonville, N. Y	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, 1.00 per yd.			
Cherokee, Ia.			.80 per ton—1.20 washed			
Detroit, Mich.	1.10•					
Dudley, Ky. (Crushed Sand)..		1.05		1.00		
Elkhart Lake, Wis.			Washed gravel .66			
Fishers, N. Y.	.65@ .85	.75@ .85				.65@ .85
Ft. Jefferson, Mechanicsb'g, O.	**.70**	**.60**	**.60**			
Glenville, N. Y.				1.00•		
Hamilton, O.			6 in. and less, .60 per ton			
Hartford, Conn.		**1.00•**				
Hersey, Mich.		.60	.60	.60		
Indianapolis, Ind.		Mixed gravel for concrete work, .65				
Janesville, Wis.		.65			.65@ .75	
Lindsay, Tex.						.60
Oxford, Mich.					.50	
Pine Bluff, Ark.			Road gravel .60			
Roseland, La.		.75				
Saginaw, Mich., f. o. b. cars.		**.75**	**1.30**	**1.30**	**1.30**	**1.30**
St. Louis, Mo.		60% gravel, 40% sand 1.70				
Summit Grove, Ind.	**.65**	**.65**	**.65**	**.65**	**.65**	**.65**
Valde Rouge, La.						**.85**
Waco, Texas		**.80**		**1.50**		**1.30**
Yardville, N. J.		**.50@ .75**				
York, Pa.		1.10@1.20		(crushed rock sand)		

•Cubic yard. B Bank. L Lake. ‖ Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.10	2.50	1.35	1.25	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Erie, Pa.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
Emporium, Pa.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
Lebanon, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.			All sizes, $1.50, F. O. B. Chicago				
Detroit, Mich.			All sizes, 1.65, F. O. B. Detroit				
Ironton, O.	2.40		other grades 1.75@2.00				
Jackson, O.	2.00	1.35	1.70	1.35	1.35	1.35	1.35
Stuebenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	2.20	1.70	1.95	1.95	1.95	1.70	1.70
Youngstown, Dover, Hubbard, Leetonia, Struthers, Steubenville, Lowellville & Canton, O.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.00@1.25	1.15	1.05@1.10	.85@1.00	.85@ .90
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.00@1.25	1.15	1.05@1.10	.95@1.00	.85@ .90
Longdale, Goshen, Glen Wilton & Low Moor, Va.		2.50	1.00	1.25	1.25	1.15	1.05

Agricultural Lime and Hydrate

	—Agricultural Lime— Bulk	Bags	Per Cent CaO	Per Cent MgO	Agricultural Hydrate Bags
EASTERN:					
Adams, Mass.		8.00	58	0.5	
Bellefonte, Pa.	8.50	11.50	98.2	.72	12.00
Berkeley, R. I.			**50**	**18**	**15.00**
Branchton, Pa.		5.50			
Cassadaga, N. Y.—Marl		10.00	48.07	1.08	
Chippewa, Pa.	6.00		78.67	1.33	
Hot Springs, N. C.	3.00	4.50			
Lime Kiln, Md.	8.00				10.75
Lime Ridge, Pa.	6.00@7.50		80.56-62.71	3.87-1.96	
Paxtang and Lemoyne, Pa.	5.50		63	3	
Rockland, Maine		8.00	65	1	
Rosendale, N. Y.	7.00		84	7	6.00
Union Bridge, Md.	11.00	5.50	73	1	13.00
Williamsport, Pa.	6.00	10.00	75	3	10.00
West Rutland, Vt.	4.50	7.50	68	3	
West Stockbridge, Mass.					15.00
Williams and Blue Bell, Pa.		8.25	57	33	11.25
York, Pa.	8.50		92.5	.03	12.00
CENTRAL:					
Alton and Hannibal, Ill.	11.50		.95		
Delaware, O.			50.0	5-12	10.00
Knowles and Valders, Wis.	5.00	9.00	55	45	12.50
Marblehead, O.			85.10	12.92	12.00
Mitchell, Ind.					12.50
Sheboygan, Wis.	5.50	8.50	58	40.5	
Woodville, Ohio			49.16	32.43	9.50
SOUTHERN:					
Burns, Tenn.	9.50		96	0.54	12.00
Claremont, Va. (Marl.)	5.00	7.00	85-95	2-5	
Erin, Tenn.	7.50@10.00		97.82	0.12	
Karo, Va.	8.50		97	1.25	
Knoxville, Tenn.	9.00		98.23		13.00
Staunton, Va.	7.50	8.75	70	10	
WESTERN:					
Colton, Calif.			97	2	15.00
Kirtland, N. Mex.	12.00				
San Francisco, Calif.			98-99	.5-.75	19.50
Tehachapi, Cal.	12.00@15.00	14.00@17.00	98	1.00	

Miscellaneous Sands

(Continued from preceding page)

Cleveland, O.—Molding coarse	1.50@2.00
Brass molding	1.50@2.00
Molding fine	1.50@2.25
Core	1.25@1.50
Columbus, O.—Core	.60@2.50
Brass molding	2.50
Sand blast	5.00@5.50
Glass sand	3.00
Molding, fine and coarse	2.00@2.25
Conneaut, O.—Molding fine	2.25@2.50
Molding coarse	2.00@2.25
Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass Molding	2.15
Dresden, O.—Core	1.50
Molding fine and coarse	1.50@1.75
Brass molding	2.50
Dunbar, Pa.—Glass sand No. 2, damp	3.00
Traction, damp	2.85
Dundee and Chalfants, O.—Sand blast	3.00
Glass, core and traction	2.75
Molding fine and brass molding	2.25
Furnace lining	2.50
Molding coarse	2.00
Eau Claire, Wis.—Core	.75@1.25
Sand blast	3.00@4.25
Traction sand	.50
Falls Creek, Pa.—Glass sand, washed	2.50
Core sand, washed or unwashed	2.00
Furnace lining, unwashed	2.00
Molding fine, washed	2.50
Molding coarse, washed or unwashed	2.00
Sand blast, washed	3.50
Stone sawing, washed	2.50
Traction, washed	2.00
Fleetwood, Pa.—Furnace lining	2.25
Franklin, Pa. and Utica, Pa.—Traction	2.50
Brass molding	2.25
Core	1.50@2.25
Molding fine	2.25
Molding coarse	2.00@2.50
Sand blast	5.00
Greenville, Ill.—Molding coarse	1.60@1.80
Howard, O.—Glass sand	3.00@3.25
Steel molding	2.25@2.50
Joplin, Mo.—Stone sawing and roofing	1.25
Kansas City, Mo.—Missouri River core	.80
Kasota, Minn.—Molding coarse and stone sawing	1.65
Klondike and Gray Summit, Mo.—Molding fine	2.00@2.50
Molding coarse	2.50@3.00
Mapleton, Pa.—Core, furnace lining, molding coarse and brass molding	2.00@2.75
Molding fine	2.25@2.75
Roofing sand	2.00@3.00
Sand blast	1.50@2.00
Massillon, O.—Glass sand, molding fine and coarse, core, and furnace lining	3.00
Traction	2.50
Michigan City, Ind.—Core, glass, traction and brass molding	.60
Millington, Ill. — Glass, core, furnace lining, roofing and stone sawing	1.75
Mineral Ridge, O. — Core, molding, sand blast, roofing, etc., washed, screened (damp)	2.25
Montoursville, Pa.—Core and traction	1.00@1.50
Brass molding	1.25@2.00
New Lexington, O.—Molding fine	2.25
Molding coarse	2.00
Sand blast	3.00
Glass, core and traction	2.75
Furnace lining	2.50

Miscellaneous Sands

(Continued)

Brass molding	2.25
Oregon, Ill.—Core and glass sand	2.00
Furnace lining	2.00
Molding fine and coarse	1.00
Sand blast	3.50
Stone sawing	2.00
Ottawa, Ill.—Crude silica sand	1.00@1.25
Core, molding, fine and coarse	1.00@2.25
Furnace lining	1.25@2.00
Roofing and traction	2.00
Sand blast and stone sawing	4.00@5.00
Ottawa, Minn.—Core	2.00@2.50
Glass, molding coarse, roofing, stone sawing (all crude silica)	1.25
Ridgeway, Pa.—Glass sand, green	2.25
Glass sand, wash	2.50
Molding, fine and coarse	1.20
Rockwood, Mich.—Core	2.75@3.25
Roofing	3.25@3.50
Sand blast	4.00
Round Top, Md. — Glass sand, core and roofing sand; washed, damp	1.75@2.00
San Francisco, Cal.—Glass and roofing	3.00@3.50
Core, molding fine and brass	2.30@2.60
Furnace lining and molding coarse	3.60@4.25
Coarse core sand	3.60@4.25
Sand blast	2.30@3.60
Stone sawing and traction	2.30
Thayer, Pa.—Traction	1.50@1.75
Furnace lining	1.10
Molding fine and coarse	1.10
Core, green	1.75@2.00
Tulsa, Okla.—Sand blast	6.50
Utica, Ill.—Core and furnaoe lining	1.00@1.25
Molding, fine and coarse	1.00
Stone sawing and roofing	1.25
Sand blast	3.50@4.50
Traction	1.75
Warwick, Ohio—Core, furnace lining, molding fine and coarse (dry)	2.50
Same, green	2.25
Wedron, Ill.—Core (crude silica)	1.00@1.25
Molding fine and coarse	1.00@1.25
Furnace lining	**1.25**
West Albany, N. Y.—Molding fine	**2.25**
Molding coarse	**2.25**
Winnipeg, Man., Can.—Roofing sand	**4.00**
Zanesville, Ohio — Molding fine and brass	1.75@2.25
Molding coarse	1.65@2.00
Furnace lining	2.50@2.75
Glass, core and traction	2.75
Sand blast	3.00
Steel molding	2.50
Pulverized silica thru 140 mesh	8.50
Thru 200 mesh	9.50

Crushed Gypsum

Akron, N. Y.	3.50
Blue Rapids, Kan.	3.50
Castalia, O.	3.50
Ft. Dodge, Ia.	3.50@4.00
Grand Rapids, Mich.	3.50
Gypsumville, Man., Can.	3.50
Oakfield, N. Y.	**4.00**
Gypsum, O.	3.50
Port Clinton, O.	4.50
Rapid City, S. Dak.	5.00
Saltville, Va.	**4.50**
Winnipeg, Man., Can.	5.00

(Gypsum) Land Plaster

Akron, N. Y.	4.50
Blue Rapids, Kan.	4.50
Castalia, O.	6.00
Bags extra—Jute 3.00; ppr., 1.00.	
Ft. Dodge, Ia.	4.50
Garhutt, N. Y.—Bags extra	7.50
Grand Rapids, Mich.	4.50@7.50
Gypsum, O.	4.50
Mound House, Nev.	7.40@8.00
Sacks, .25 extra.	
Oakfield, N. Y.	7.50
Los Angeles, Calif.	12.50

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75%	6.00@8.50
B.P.L. 65%	8.00
Gordonsburg, Tenn.—B.P.L. 68%	6.00@7.00
B.P.L. 70%	7.50@8.00
B.P.L. 72%	8.50@9.00
Mt. Pleasant, Tenn.—B.P.L. 75%	8.00@9.00
Paris, Idaho.—2,000 lb. mine run, B.P.L. 70%	4.50
Wales, Tenn.—B.P.L. 70%	7.75

Ground Rock

Per 2000-lb. Ton

Centerville, Tenn.—B.P.L. 70%—90% thru 100 mesh	9.00@10.00
B.P.L. 75% (brown rock)	12.00
Mt Pleasant, Tenn — B.P.L. 68%—13% Phosphorus	7.50@9.00
14% Phosphorus	8.00
B.P.L. 65@70%	7.00@9.00
Norwills, Fla.—(Fla. Hard Rock)—B.P.L. 68%	10.00

Florida Soft Phosphate

Raw Land Pebble

Per Ton

Bartow and Norwills, Fla.—B.P.L. 50%, bulk	6.00@ 8.00
B.P.L. 78%, bulk	13.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

Per Ton

Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Lakeland, Fla.—B.P.L. 72%	13.50
B.P.L. 60%	6.00

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags:

New York (del.)	$2.80
New York, alongside dock, to dealers	2.40
Jersey City (del.)	2.89
Boston	2.86
Chicago	2.17
Pittsburgh	2.17
Cleveland	2.43
Detroit	2.43
Indianapolis	2.43
Toledo	2.49
Milwaukee	2.39
Duluth	2.10
Peoria	2.45
Cedar Rapids	2.51
Davenport	2.47
St. Louis	2.20
San Francisco	3.09
New Orleans	3.36
Minneapolis	2.41
Denver	3.10
Seattle	3.10
Dallas	2.60
Atlanta	2.75
Cincinnati	2.57
Los Angeles	3.21
Baltimore (del.) drayload lots	3.58
Birmingham	3.05
Kansas City	3.20
Montreal	3.44
Winnipeg	3.36

NOTE—Bag charge is generally 10c each.

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Bound Brook, N. J.—Trap rock, carload lots; bulk		2.30
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Green Marble, loose in cars	14.00	12.00
Lincoln, Neb. — Red, white, grey, in bags		30.00
Middlebrook, Mo.—Red granite; sacks	30.00@35.00	20.00@25.00
Milwaukee, Wis.		10.00@12.00
Missouri river points — Different colors	20.00@25.00	20.00@25.00
Piqua, O.—Marble	8.00@10.00	8.00@10.00
Tuckahoe, N. Y.—White Marble	12.00	12.00
Crushed white stone and marble dust in 100 lb. bags	8.50@12.00	
Tate, Ga.—White limestone, sacks extra	6.00@ 7.00	6.00@ 7.00
Wausau, Wis.	14.00@18.00	
Wisconsin and S. Dak. points—Granite, different colors, bulk or sacks	1.50@ 2.00	3.00@ 7.00
Granite dust in bags	6.00	

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	13.00@14.00
Barton, Wis.	14.00
Brighton, N. Y.	17.00
Buffalo, N. Y.	16.50
El Paso, Texas	14.00
Gary, Ind.	11.50@12.00
Grand Rapids, Mich.	15.00
Lancaster, N. Y.	14.50
Michigan City, Ind.	11.00
Miller, Ind.	10.00@10.50
Milwaukee, Wis. (delivered at job)	17.50
Minneapolis, Minn.	13.00
Portage, Wis.—Common	15.00
Face	25.00
Redfield, Mass.	15.00
Saginaw, Mich.	14.75
San Antonio, Texas—Common	18.00
Face	25.00
South Dayton, Ohio	16.50
Syracuse, N. Y. (delivered at job)	20.00
F. o. b. cars	18.50
Toronto, Can.	17.00
Washington, D. C.	14.50
Winnipeg, Can. (less $1 trade disc.)	19.00

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f.o.b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$ 9.30	$8.40	$8.10	$8.10
24x14	9.30	8.40	8.10	8.10
22x12	10.72	8.70	8.77	9.10
22x11	10.72	8.70	8.77	9.10
20x12	10.72	8.70	8.77	9.10
20x10	11.70	9.60	9.42	9.42
18x10	11.70	9.60	9.42	9.42
18x 9	11.70	9.60	9.42	9.42
16x10	11.70	9.60	9.42	9.42
16x 9	11.70	9.60	9.42	9.42
16x 8	11.70	9.60	9.42	9.42
18x12	11.05	9.30	9.10	9.10
16x12	11.05	9.30	9.10	9.10
14x10	11.05	9.30	8.77	8.77
14x 8	11.05	9.30	8.77	8.77
14x7 to 12x6	10.40	9.00	8.45	.....
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$7.50	$7.50	$5.75
22x11	9.10	7.75	7.75	5.75
Other sizes	9.10	8.10	8.45	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

The following are the prices per square for slate, f.o.b. cars quarries, Granville, N. Y., the prices given in each case being for No. 1 Sea Green Roofing Slate:

22x11, 20x12, 20x11, 20x10, 18x12, 18x10, 18x9, 16x12, 16x10	10.20
24x12, 22x12, 16x9, 16x8, 14x12, 14x10	9.90
26x14, 24x14, 22x14, 20x14	9.60
14x9, 14x8, 12x10	9.00
14x7, 12x9, 12x8	8.70
12x7, 11x8, 11x7, 10x8	7.50
12x6, 10x7	7.20

Granulated slate per net ton, f. o. b. quarries, Vermont and New York, 7.50.

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Common
New York	$21.00	$20.00
Chicago	20.00	.....
St. Louis	26.00	20.00
Boston	27.25	22.75
Dallas	27.50	25.00
Cincinnati	17.60	16.60
San Francisco	25.40	22.00
Minneapolis	29.00 (white)	22.00
Denver (bbl.)	32.00	.....
Detroit	22.00	19.00
Seattle	24.00	.....
Los Angeles	30.00	30.00
Baltimore	22.25	17.50
Montreal	30.00	.....
Atlanta	22.50	15.00
New Orleans	.....	22.50
Winnipeg	.....	21.20

	Lump per 200-lb. Barrel Finishing	Common
New York	$ 3.50 at plant	$ 3.30*
Chicago	.....	1.65
St. Louis	.....	2.50*
Boston	3.65	3.40
Dallas	.....	2.50†
Cincinnati	.....	13.10‡
San Francisco	.....	2.25
Minneapolis	2.00	1.70
Denver	1.00 (bu.)	3.20
Detroit	2.00†	1.80†
Seattle	3.25	2.75
Los Angeles	3.00*	3.00*
Baltimore	.....	12.75‡
Montreal	15.00‡	.....
Atlanta	.....	1.25
New Orleans	.....	2.25
Winnipeg	3.20	13.80‡

Natural Cement

Current price for 500 bbl. or over, f.o.b., exclusive of bags:

Minneapolis (Rosendale)	$2.80
Kansas City (Ft. Scott)	1.60
New Orleans	3.36
Atlanta (Magnolia)—ton	11.00
Boston (Rosendale)	2.35
Cincinnati (Louisville)	2.75

*300-lb. barrels. †Per 180-lb. barrel. ‡Per ton.
NOTE—Refund of 10c per barrel.

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Baltimore, Md.—Crude talc	4.00
Cubes	50.00
Blanks, per lb.	.08
Chatsworth, Ga.—Crude talc	8.00@10.00
Ground talc (150-200 mesh), bags	12.50
Pencils and steel workers' crayons, per gross	1.50@ 2.00
Chester, Vt. — Ground talc (150-200 mesh), bulk, 10.50@12.00; bags	12.00@14.00
Emeryville, N. Y.—Crude Talc	4.00
Glendale, Calif. — Ground talc (150-200-mesh	16.00@30.00
(Bags extra)	
Gouverneur, N. Y.—Crude talc	4.00
Ground talc (150-300 mesh)	17.00@24.00
Henry, Va.—Crude talc (lump mine run), per 2000-lb. ton	2.75@ 3.25
Ground talc (20-50 mesh), bags, 7:50; bulk	6.25
Ground talc (150-350 mesh), bags	11.25@13.50
Johnson, Vt.—Ground talc (20-50 mesh), bulk	8.50
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@20.00
(Bags extra)	
Keeler, Calif.—Ground talc (200-300 mesh), bags	18.75@32.00
(Bags extra)	
Los Angeles, Calif.—Ground talc (20-50 mesh) 200-lb. bags	12.00
Ground talc (150-200 mesh) 200-lb. bags	15.00@25.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@18.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	8.50@10.00
Ground talc (150-200 mesh); bags	9.00@16.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	8.50
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@15.00
(Bags extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Concrete Brick

Prices given per 1,000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	18.00@20.00	28.00@36.00
Bellow Falls, Vt.	20.00	35.00
Bridgeport, Conn.	31.00	32.00
Buffalo, Niagara Falls and Rochester, N. Y.	21.00	.....
Eau Claire, Wis.	20.00	30.00@40.00
Houston, Tex.	.....	22.00
Lockport, N. Y.	17.00	.....
Milwaukee, Wis.	17.00@18.00	35.00@65.00
Omaha, Neb.	32.00	42.00
Piqua, O.	18.00	25.00
Portland, Ore.	25.00	43.00@73.00
Fancy brick	100.00@150.00	
St. Paul, Minn.	18.00	32.00
Springfield, Ill.	18.00	20.00@25.00
Tonawanda, N. Y.	20.00	.....
Virden, Ill.	18.00	20.00@25.00

General Market News

Conditions in Lehigh Valley Cement Districts

OVER-PRODUCTION at the various mills in the Lehigh Valley section of Pennsylvania during past weeks has led to filled storehouses, and to such a point that many of the plants are commencing to curtail outputs. This situation was intimated in the last issue of ROCK PRODUCTS, and has now become a reality. The call for material is far from what it should be at this season, and made all the more intensive by the utter lack of export demand. Outlets for material is the big factor in the situation at the present time.

Cement shipments from this district during May have averaged about 150 carloads a day. The revival in construction operations has not, as yet, reached a point where the effect can be felt at the cement mills, and while roadbuilding is looming as an encouraging phase in the situation, yet the immediate work in this line is more of a nature of preliminaries, with many bids asked, but not so many contracts awarded. At the same time, the outlook is good, and there is no question but that a few weeks will show a decided improvement in matter of call for cement from this source.

The New York market in cement is rather "spotty"; the increasing activity in large apartment house work has had the effect of bringing a better demand during the past fortnight, with every indication that the coming months will show increased use of cement and other building materials. While there is a tendency to push prices to lower levels, cement is one of the basic commodities that is holding its own in the Metropolitan districts, and quotations hold at $3.20 a barrel, delivered on the job; the bag rebate is 10 cents. It can be stated that the cement business is well above the average, as compared with the other material markets, and dealers are showing no hesitancy in stocking up at the present figures.

In New Jersey the situation closely parallels that of New York, with a shade higher prices being asked by local dealers at Newark, Paterson, Passiac and other points in the northern part of the state, with the southern districts, including Trenton and vicinity, asking around $3.40 for barrels, delivered. Road work is coming forward at a good pace in this state and several interesting contracts are pending that will absorb considerable material.

Cement has sagged in price during the Here the quotations stand at $3.26 a barrel, delivered, as compared with $3.90 at the beginning of May, and now closely approaching the level as established at New York. In paper, the material is being turned at $3.01 a barrel. Common lime at Boston has now reached a point of $2.80 a barrel, 180 pounds net, delivered, and $4.08 a barrel of 280 pounds. Finishing lime is $3 per barrel of the first weight noted, and $4.38 for the 280-pound barrel. Hydrate finishing lime is selling at $19.50 per ton in paper in the Boston market.

There is no change in the price of cement at Providence, R. I. At the present writing, the $4.60 a barrel quotation is being maintained by leading dealers. There is a drop in sight, however, and it only seems a matter of a very short time when a new schedule will be arranged. Barreled lime is selling for $3.25 and $4.50 for 180 pounds net and 280 pounds net, respectively. Hydrate lime is being sold at $1.70 per 100-pound bag.

The Lehigh Valley section shows rather a spasmodic condition as regards immediate activities; some mills are busy, and others are working under "light" advance orders. There is a keen outlook for trade and every effort is being made to secure orders. The large plant of the Atlas Portland Cement Co., at Northampton, continues under good production, and large shipments are going forward; Sunday work has recently been the order of things and a number of shifting crews having been on the job on this day, the first time, incidentally, for many months past. The Coplay Cement Co. is operating on a curtailed schedule, as are several of the other large mills, while smaller plants, experiencing the full stress of the situation, are now arranging to close for a time, or until advance business warrants production.

Rates on Crushed Rock

A FINDING of unreasonableness as to rates on crushed rock from Leeds, Mo., and Rosedale, Kans., to destinations within a radius of 150 miles from Kansas City has been made in No. 11148, Prince-Johnson Limestone Co. vs. A. T. & S. F. et al., opinion No. 6877, 61 I. C. C., 602-4. The finding is that the allegations of undue prejudice had not been sustained, but that the intrastate rates under assault were, during Federal control, and the interstate rates were, are and for the future will be, unreasonable to the extent that they exceeded, exceed, or may exceed by more than one cent per 100 pounds, the contemporaneous rates on the same commodity from Kansas City to the same destinations. The carriers are to line up their rates in accordance with that finding on or before August 18. The plea for reparation was denied because there was no proof of shipments or other evidence to support the plea for reparation.—"The Traffic World."

California Plaster Manufacturer Cuts Prices

A REDUCTION of from 10 to 35 per cent in the price of plaster materials was announced recently by J. W. Jameson, president of the Blue Diamond Plaster Co., Los Angeles, Calif. The cut, he stated, was made possible by the reduced cost of labor which has taken a very noticeable drop since last year.

Following a conference of the company officials, it was agreed that the drop in prices would be a timely move to increase building activities in the city. Prices of plumbing materials and lumber experienced a decrease of a similar percentage some time ago, Mr. Jameson said.

Among the important plastering materials which were announced to take a big drop in prices are:

	Old Price	New Price
No. 16 marble dust, ton	$20.00	$15.00
Corner beads, per foot	.07	.05
No. 16 wire netting, yard	.24	.18
No. 18 wire netting, yard	.20	.13
Plaster, ton	28.00	23.00
Casting plaster, ton	30.00	24.00
Hydrated lime, ton	30.00	21.00
Metal lath, yard	.35	.27

Phosphate Concerns Combine for Export

PAPERS have been filed with the Federal Trade Commission, Washington, D. C., by the Phosphate Export Association in combination with the Florida Hard Rock Phosphate Export Association, under the Webb-Pomerene law, for the purpose of engaging in export trade.

The main office of the combination will be in New York City, with branches in Savannah, Ga., and London. The Phosphate Export Association comprises four concerns in New York City—the International Agricultural Corporation, Coronet Phosphate Co., Phosphate Mining Co. and Southern Phosphate Corporation. The Florida association comprises five concerns in Florida and Georgia—J. Buttgenbach and Co., Dunnellon, Fla.; C. and J. Camp, of Ocala, Fla.; Cummer Lumber Co., of Jacksonville, Fla.; Dunnellon Phosphate Co., of Savannah, Ga., and Mutual Mining Co., of Savannah.

News of the Industry

Incorporations

The Caldwell Concrete Pipe Co., Caldwell, Ida., has been incorporated for $30,000.

The Holston Quarry Co., Knox County, Tenn., has increased its capitalization from $10,000 to $200,000.

The Cement Products Co., Renton, Wash., has been incorporated for $15,000 by L. A. Shew, Fred Miller and W. A. Greene.

The Madison Cement Stave Silo Co., Madison, Wis., has been incorporated for $125,000, by Wm. W. Gurney and Clyde C. Woody.

The Arkansas River Sand Co., Tulsa, Okla., has been incorporated for $10,000 by S. G. Wilbur, Margaret Wilbur and W. E. Roberts.

The Lexington Cut Stone Co., Lexington, Ky., has been incorporated for $10,000 by H. Van Antwerp, David Smith and C. H. Wilder.

The Modern Cement Block Co., Toledo, O., has been incorporated for $10,000 by W. J. Campbell, I. A. Campbell, O. L. Harrison and R. A. Forster.

The General Stone Sales, Limited, Toronto, Ont., has been incorporated for $40,000 to carry on the business of quarrymasters and stone merchants.

The United Fertilizer and Lime Co., Dover, Del., has been incorporated for $6,100,000 to manufacture and sell mineral and artificial fertilizers.

The Pittsburg Concrete Brick Products Co., Wilmington, Del., has been incorporated for $100,000 to manufacture and sell concrete building blocks.

Master Cement, Ltd., 16 Hastings St., East, Vancouver, B. C., has been incorporated for $30,000 to acquire the rights to manufacture "Master Cement."

The Pacific Sand Co., Manhattan, N. Y., has been incorporated for $10,000 by M. Feinstein, F. W. Shepard and S. Heff. The company will engage in dredging work.

Forrest S. Hart and Son, Batavia, N. Y., has been incorporated by Forrest S. Hart and Glenn C. Hart for the purpose of promoting the manufacture of concrete staves.

The Harbour Sand & Gravel Co., Ltd., 504 London Bldg., Vancouver, B. C., has been incorporated for $150,000 to carry on the business of sand, gravel and stone merchants.

The Vibrated Cement Products Co., Fresno, Cal., has been incorporated for $20,000 by H. S. Duff, J. C. Wheeler, B. E. Dake, Frieda Spitzbart and Stanley Moffatt, all of Fresno.

The Universal Tile Co., Milwaukee, Wis., has been incorporated for $15,000 by Eugene and Arthur Cafemeyer, and Isabel Hansen, all of Milwaukee. The company will manufacture tiles.

The Utica Lime Co., Sellersburg, Ind., has been incorporated for $10,000 by W. E. Hyatt, president; B. L. Hyatt, vice-president; H. Gertrude Hyatt, secretary-treasurer, and Elizabeth P. Hyatt.

The Widell Co., 229 S. Front St., St. Mankato, Minn., has been incorporated for $50,000. Of this amount $23,000 is to be used in Wisconsin. K. H. Smith, Hamilton, Fond du Lac county, Wis., will represent the company in Wisconsin. The company will do construction work of all kinds.

Lime

The Peerless White Lime Co.'s plant at Ste. Genevieve, Mo., which was reported in the May 21 issue of ROCK PRODUCTS as being destroyed by fire, is now being reconstructed and the entire burned section will be in full operation some time in June. The company assures its customers that all orders will be promptly filled and the fire has in no way prevented the company from filling orders.

Quarries

The Markle Stone & Lime Co., Markle, Ind., has filed preliminary certificate of dissolution.

The National Stone Co., Minneapolis, Minn., has started work on its East Sioux quarry, and as soon as the machinery is installed the plant will start operating.

J. T. Herrick, of Delaware, Ohio, is testing by core drilling and chemical analysis, a tract of 350 acres of limestone near Delaware. Should the test prove satisfactory a crushing plant of capacity of 2,500 tons daily will be built.

The Great Lakes Corp., Milwaukee, Wis., is installing a large rock crusher with a capacity of 80 tons of rock a day. With the new crusher in operation six or seven different grades of stucco chips will be produced. The corporation reports that the demand for stucco chips is good and that it will be operating 16 hours a day by the first of July.

The Spoor-Lasher Co. announces that improvements entailing an expense of about $5,000 will be made at once at the quarry on the Pennock property. New machinery will be installed and new storage bins, which will have a capacity of 200 tons, will be erected. The quarry will produce crushed stone of various sizes, as well as building stone. When the contemplated improvements are made the quarry will have a capacity of 20,000 cubic yards a season.

Phosphate

The Standard Ground Rock Phosphate and Fertilizer Co., Centerville, Tenn., has been reorganized as the **Standard Fertilizer Co.**, with capital stock of $480,000, by A. H. Grigsby, president; H. H. Campbell, vice-president, and C. A. Betts, secretary and treasurer. The new company will be producers of Standard brand rock phosphate (ground) and (brown) lump rock phosphate.

Sand and Gravel

The River Sand and Gravel Co., Owensboro, Ky., has increased its capitalization from $10,000 to $30,000.

The Lincoln Sand and Gravel Co., Lincoln, Ill., has started the construction of a barge for use in its sand and gravel operations.

The Superior Gravel Co., Wyandanch, N. Y., has been recently organized to operate a gravel plant. Mr. Danielson, of Brooklyn, is president of the company.

The Fort Worth Sand and Gravel Co., Fort Worth, Tex., is to erect an elevator and storage bins in the Rock Island freight yards at a cost of about $10,000.

The Atlas Sand, Gravel and Stone Co., Hartford, Conn., has employed the engineering department of the Greenville Gravel Co., Greenville, O., to design and install a 25,000-ton ground storage plant.

Paducah, Ky.—Extension of the Illinois Central south yards is announced, the work to start soon. New tracks, new gravel work and equipment will be made, the improvements to cost around $1,000,000, it is stated.

The Central Sand and Gravel Co., 1706 Arcade Bldg., St. Louis, Mo., is operating a large plant at Wilson, Ark. They have a capacity of 1,000 cubic yards daily and are giving special attention to highway and railroad work.

The United States Building Materials Co., Chicago, Ill., is said to have paid about $169,050 for the Federal Sand and Gravel Co.'s plant in South Beloit, Wis. The plant is located near the Chicago and North Western Railroad.

The Wolf River Sand Co., No. 4, North Front St., Memphis, Tenn., report good summer activities in both sand and gravel. Building in Memphis has developed considerably the last 30 days. There were some reductions in prices made in April, sand in city limits being placed at $1.95 per ton; per yard, $2.75. Gravel in city limits, per ton $2.40 and per yard $3.60. They also do a large carload trade. Their sand and gravel is washed and screened twice. Wolf River sand, on account of its fine particles filling the voids of coarse, sharp material, ranks very high.

Cement

The Hanover Portland Cement Co., Welland, Can., plant has re-opened after being closed down for two months to make certain changes and additions. The company will make cement from limestone rock.

Concrete Products

The Bemidji Concrete Mfg. Co., Bemidji, Minn., has orders on hand for more than 1,000,000 brick and will start operating as soon as the machinery on hand is installed.

The Independent Concrete Co., Webb City, Mo., has resumed operations after installing a complete line of block-making machinery. Mr. Degginger is the president of the company.

The Walker Concrete Stone Co., Tacoma, Wash., has purchased a site near Center and State Streets, and will move its plant to that point from Puyallup Avenue. About $50,000 will be invested in the new factory.

The Acme Brick Co., Barton, Wis., is not affected by the present business depression having plenty of business to keep the plant working to full capacity. The company will install another hydraulic press to enable it to turn out enough material to supply the demand.

Dyer County, West Tennessee, has sold $670,000 of bonds for road construction purposes and will proceed with 60 miles of hard surfaced road work. Bids will be opened June 3 for an eight-mile section of the Jeff Davis Highway. This means in connection with other work done and planned 117 miles of hard surfaced roads for Dyer County.

Manufacturers

Orton and Steinbrenner Co., Chicago, Ill., has issued Catalog No. 20 describing its line of 7 and 12-ton crawling tread and road wheel locomotive cranes.

The Ellicott Machine Co., Baltimore, Md., has issued a new catalog wherein is illustrated several different types of dredges manufactured by the company.

The Draper Mfg. Co., Cleveland, Ohio, has issued Catalog No. 7 describing the steel barrels manufactured by the company. Several pages in the back of the catalog are given to tables of useful data.

The United States Portland Cement Co., Denver, Colo., has just issued a two-page folder which contains useful information regarding aggregates and portland cement in concrete work. The practical user of concrete would find this folder valuable.

The Jeffrey Mfg. Co., Columbus, Ohio, announce that after June 1 its New York City office will be located in the Hudson Terminal Building, 30 Church Street. Harold B. Wood is now in charge of the company's New York office as district manager.

The Browning Co., Cleveland, Ohio, has just issued a new 48-page catalog describing the Browning cranes. The first 12 pages are devoted to a description of the cranes and their capacities while the balance of the catalog contains illustrations of the use of the cranes.

The Engineering Advertisers' Association of Chicago will gather in the Fraternity Room, Great Northern Hotel on June 7th at 8 p. m. for its last meeting prior to summer adjournment. The meeting is announced as Executives' Night, and the Association is most fortunate in securing Charles Piez as a speaker. Mr. Piez is president of the Link-Belt Co., and is nationally known as Director-General of the United States Shipping Board Emergency Fleet Corp. during the late war. He will address the gathering on "Advertising and Selling from an Executive's Viewpoint."

Chris D. Schramm and Son, Inc., West Chester, Pa., announces that its former offices in New York City at 480 Lexington Avenue and 140 West Street are being moved to 54 Dey Street, where they will occupy the entire first floor. They have, during the last year, added many additional sizes and styles to their line of compressors and pumps, and now have to offer a rather complete line of both portable and stationary air compressors up to 160 ft. per min. displacement, as well as a complete line of engine and motor-driven diaphragm centrifugal and triplex pumps. Literature covering the new Schramm line is ready for distribution.

The Schaffer Engineering & Equipment Co., Pittsburgh, Pa., has recently been called upon for several designs of crushing plants which are to serve a truck and wagon trade as well as railroad shipments and which range in capacity from 50 to 100 tons of stone per hour. Owing to high

transportation rates, poor conditions of roads, due to lack of proper repairs, the urgent necessity of cheap and rapid construction of a great highway mileage, there seems to be a tendency to revert to small semi-portable crushing plants for special localized service. Several marked examples of this method which has been brought about by almost impossible transportation conditions and rates have been projected. In the design of such a crushing plant the builder and future operator has been very quick to see that unless it is handled with purely operating conditions in view as to cheapness in production, minimum of repairs and breakdowns, that such a policy may act as a boomerang. It has been surprising the comparatively low cost at which an all-steel motor-driven highly flexible and dependable unit can be constructed and with a capacity which is not exactly small. The proper selection of the equipment designed for bunker capacity depending upon local conditions and other salient points make the laying out of such a plant a matter of considerable thought and practical application of scientific principles. Also, the conditions under which the plant will actually operate has a great deal to do with its future success. The Schaffer Engineering & Equipment Co. by reason of their wide experience in this line have been able to meet the conditions involved in a highly satisfactory manner.

Dealers

The Fischer Lime and Cement Co., 269-289 Walnut St., Memphis, Tenn., has recently completed an addition to its new warehouse and office building. Portions of the new addition under construction many months have been occupied, but the finishing touches are just being put on the office, big dining room on the front of the building, etc. The new addition is 100x300 ft., two stories and a basement, built of reinforced concrete, the exterior corresponding in finish with the original building, handsome with terra cotta and white effect and now covering in entirety the block from Linden St. to Pontotoc St. and from Walnut St. back to the Southern R. R., with special trackage from the latter line to the plant. Classification of the many departments for plaster, paints, roofing, sewer pipe, lime, cement, fireproofing, coal tar products, asphalt, creosotes, etc., is very complete and well arranged. A large line of waterproofing products is carried. The building was constructed in its concrete features by the Kaucher-Hodges Co., of Memphis, engineers. W. W. Fischer states that summer activities look good. Their gravel and sand business at Greenville, Miss., is active. Their crushed stone plant at Williford, Ark., is operating. A feature of the Fischer Lime and Cement Co.'s new addition is a very commodious office and a dining room large enough to seat the entire working force. The company's Little Rock branch, which is operated separately, is having a very active June trade.

John A. Denie's Sons Co., 82 South Front St., Memphis, Tenn., report good summer activities in lime and cement products, which were delayed somewhat by spring rains, but are much more active with the warm days. They are handling Acme cement plaster, Dixie Royal cement, Moss-DeVoy lime, tile, crushed stone, gravel, roofing paints, fire brick, etc. They have been much complimented for the showings made by their materials in the handsome Pantages Theater recently opened on Main St., Memphis.

AN ENGINEER in France, who proposes to equip a large number of plants for the preparation of materials for the reconstruction of the devastated regions of that country, desires to be placed in touch with American firms for securing cement-working machines of large capacity; pneumatic or electrical operating machines for tamping cement; special winches; excavating and loading machines; stone crushers; automatic brick and tile-making machines, with or without turntables; machines of large capacity for making tiles of fibro cement; machines for crushing bricks, cinders, rubbish, etc.; machines for making paving bricks, and for making blocks or tiles of sawdust by compression; and a large type machine for making artificial stone of a variety of sizes, which will be able to produce between 20 to 40 cubic meters per day of 10 hours' work. Specifications and illustrations, giving the production of each machine, the number of hands needed for operation, and any other pertinent information, should be given. These machines should be for operation with petroleum, gasoline, or heavy oil fuel. Correspondence should be in French. No reference offered.—Reprint from Commerce Reports, Department of Commerce, Washington, D. C., May 21, 1921, page 1072, opportunity number 34925. Reserved information may be obtained from the Bureau and its district and co-operative offices by duly registered firms and individuals upon written request by opportunity number.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

Locomotives for Rent and Sale

2—32-ton Vulcan four-driver saddle-tank, used sixty days, built March, 1921.
1—40-ton 17x24" four-wheel switcher.
2—50-ton 18x24" six-wheel switchers.
2—NEW 25-ton six-wheel Porters, separate tenders, 36" gauge.
2—18, 14, and 10-ton Vulcans, 36" gauge.

MISCELLANEOUS

13—6-yd. rebuilt dump cars, std. gauge.
20—12-yd. Westerns, like new, std. gauge.
50—60,000-lb. capacity flat and box cars.
1—Western standard gauge spreader.
1—Osgood 18 revolving shovel, traction wheels, No. 794.
1—Marion 36 steam shovel on traction wheels.
1—Marion 76 steam shovel, No. 3503, std. gauge.
2-in., 4-in., and 6-in. simple, duplex, and centrifugal pumps, new 3-drum hoists, road rollers, and tripod drills.

Locomotive-Cranes, Railway Equipment, etc.

INDUSTRIAL EQUIPMENT CO.
McCormick Building, Chicago, Ill.

Large Crushers

JAW: 24x36-in. Farrel type 15B. 10x36-in. type 22B. Virginia delivery.

Gyratory: Two No. 6 Chalmers & Williams. New Jersey delivery.

All good condition. Do you want details on these or other sizes? Relaying rails in stock.

E. H. Wilson & Company
Commercial Trust Building
PHILADELPHIA

FOR SALE

2 Heine Watertube Boilers, 409 Hp. each. For further particulars address

Phoenix Portland Cement Co.
Nazareth, Pennsylvania

"Everything for the Quarry"

¾-yd. Thew "O" Traction Shovel.
3-ton Plymouth 4' 8½" ga. Gasoline Locomotive.
7x12 cyl. 36-in. gauge Davenport Saddle Tank.
9x14 cyl. 36-in. gauge Vulcan Saddle Tank.
10x16 cyl. 36-in. gauge Porter Saddle Tank.
10—24-in. gauge 1½-yd. Western Dump Cars.
15—36-in. gauge 4-yd. Western Dump Cars.
3—16-yd. Western Air Dump Cars.
33-in. R. H. Lehigh Fuller Mills.
7x10 and 8x10 DC, DD Hoisting Engines.
Rails, Boilers, Derricks, Steam Shovels, Tanks.

ZELNICKER IN ST. LOUIS
Before You Buy Get Big Bulletin 290.

FOR SALE

9x16" Climax Jaw Crusher.
No. 2 Style D Gates Gyratory Crusher.
75 H. P. 13x16" Erie Steam Engine.
125 H. P. 18x24" Atlas Steam Engine.
12x12" Lidgerwood Standard, Double Cylinder 2 Drum Cableway Engine.
600 lineal feet 1¾" Roebling Wire Cable.
100 H. P. Motor and 100 K. W. Generator. Both 550 volts and 60 cycles.

E. W. Cooper, 174 3rd Ave. No., Nashville, Tenn.

New—RAILS—Relaying

All sections on hand for quick shipment. Reasonable prices quoted. Our stock is very complete.

M. K. FRANK
Frick Building Pittsburgh, Pa.

Immediate Delivery

6, 7½, 9, 10 and 18 K Crushers

18 K ANGLE DR. $11,000.00.
No. 4 GYRATORY CRUSHING PLANT. N. Y.
No. 36 DISC CRUSHER, MANG. FITTED.
2—150-Hp. 125-lb. Marine type boilers and others.
No. 10 McCULLY—BARGAIN, $6,750.00.
4 No. 6 Gates (Mang. Fit.) nickel steel shafts.
50- and 75-Hp. single drum hoists for motor drive.
No. 2, 3 and 4 Gates, reg. drive crushers.
Air Compressors (steam-belt) 50 to 4000 ft.
5, 6 and 12 ton, 24-in. gauge gasoline locomotives.
1—8x8 and 10x10 Air Comp. (belt).
2—180-ft. Quick Shift, 30-ft. bucket towers.
6-in., 8-in. and 10-in. SAND PUMPS.
25—40-Hp. Thomas D. D. Elec. Hoist, 440 V. A. C.
5,- 10- and 15-ton HOLT TRACTORS, PRAC. NEW.
1, 2 and 3 DRUM STEAM AND ELEC. HOISTS.
Send us your inquiries—Sand Pumps, Motors, Contractors' Equipment, etc.

ROSS POWER EQUIP. COMPANY
Indianapolis, Ind.

FOR SALE

One Erie Steam Shovel, Type B, No. 1321, in perfect condition; only been used 4 months.

The Smallwood-Low Stone Co.
Lisbon, Ohio

Immediate Shipment

15,000 new curved corrugated sheets. These sheets can be used for culverts and also concrete forms. Material new. Was purchased for trench shelters.

M. K. FRANK
Frick Building Pittsburgh, Pa.

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. please send check with your order. These ads must be paid in advance of insertion.

Repaired Contractors' Equipment

Steam Shovels

Model 60 Marion Shovels, 2½-yard dippers, Nos. 1999, 2059, 2130

1—Model 1 Thew, on railroad trucks, ⅞-yard dipper.

1—Bucyrus Model 70-C, Shop No. 1219.

2—Model 28 Marion Revolving, ⅝-yard dippers.
1—Model O Thew Revolving, ½-yard dippers.
1—Type "B" Erie Revolving, ¾-yard dippers.

We have a large stock of thoroughly repaired Construction Equipment of all kinds ready for immediate shipment.

Locomotives

8—18-ton, 10x16" Porter Dinkeys, 36" gauge.
2—12-ton, 9x14" Porter Dinkeys, 36" gauge.
1—17x24", 55-ton, 4-6-0, standard gauge.
3—25-ton Forney type.

Clam Shell Buckets

1—1¼-yard Williams Hercules Bucket.

Cars

30—Western Air Dump 12-yard, standard gauge.
40—Western 4-yard, 36" gauge, steel beam.

H. KLEINHANS COMPANY
Union Arcade **Pittsburgh, Pa.**

LOCOMOTIVES

One—68-ton, standard gauge, Baldwin Mogul; 180-lb. pressure.
One—56-ton, standard gauge, American 10-wheeler; 175-lb. pressure.
Two—50-ton, standard gauge, Brooks 6-wheel switchers; 160-lb. pressure.
One—65-ton, standard gauge, Shay Geared Locomotive.
One—24-ton, standard gauge, Shay Geared Locomotive.
One—14-ton, 36" gauge, American Saddle Tank.
Two—23-ton, brand new, 36" gauge, Porter 6-wheel switchers; separate tenders.
One—Model 14-B Bucyrus Shovel.

The above are only a few items of our stock. Will gladly send you our complete stock lists.

Birmingham Rail & Locomotive Co.
Birmingham, Ala.

AUSTIN GYRATORY CRUSHERS

2—No. 2, Standard Drive
1—No. 3, Standard Drive
1—No. 5, Standard Drive
1—No. 5, Angle Drive
1—No. 6, Standard Drive
1—No. 7½, Standard Drive

These are a few specials that we wish to move quickly. We also have Crushers of other makes and sizes, also Jaw Crushers, Elevators, Screens, Conveyors, Cranes, Locomotives, Cars, Rail, Hoists and other machinery such as you use. Write us fully, and if you have excess plant, also mention what it is.

Reading Engineering Co., Inc.
1227 Tribune Bldg. New York, N. Y.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25', 3½x25', 4x30', 5½x50' 6x50' and 7x60'; double shell dryers, 4x20', 5x30' and 6x35'; steam-heated air rotary dryers, 4x30' and 6x30'.

KILNS—Rotary kilns, 3½x25', 5x60' and 6x70', 6x100', 7x80' and 8x110'.

MILLS—6x8', 6x5', 2½x3" 3x3½' pebble and ball mills; 8x4', 6x4' and 4x4' continuous ball mills; 3' March mill; 42", 33" and 24" Fuller-Lehigh mills; 4½x20', 5x11', 5x20', 5½x22' and 6x20' tube mills; 7½x13", 9x15", 16x10" and 30x60" jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 36" and 40" cage mills; 3' and 4½' Hardinge mills; 18x12", 20x12" and 30x10" roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 3 roll and No. 000, No. 00 and No. 0 Raymond mills; one No. 5 Telsmith breaker; one 36" Sturtevant emery mill; one 3 roll Griffin mill; 60" chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; one keystone excavator; 6x8', 6x5' and 4x3' Newaygo vibrating screens, Richardson automatic scales.

Air compressors and tanks.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

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Rates for advertising in the Classified Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

Plant for Sale

Stone Quarry For Sale

Dolomite lime stone quarry, well developed, with shallow overburden, the stone being excellent in quality for fluxing, open-hearth and highway construction purposes, the property consists of about 20 acres of land, buildings and all equipment necessary to operate in first class condition, this property has a railroad siding and frontage on both W. M. R. R. and the P. R. R. of more than 2000 feet, situated in West York Boro, York County, Pa., same to be sold at Public Sale on June 10th, 1921, at 1:00 P. M., when the terms will be made known.

SAMUEL W. HARBOLD
Receiver of the General Rock Products Co.
York, Pa.

Situations Wanted

POSITION WANTED

By practical Cement Mill Superintendent, 16 years' experience wet and dry plants. Can furnish A-No. 1 references and am employed at present but desire a change of location. Address

Box 1483 **Care of Rock Products**

SUPERINTENDENT

Desires engagement; twenty years' experience; thoroughly familiar with heavy production and steam shovel operation, crushing plants and gravel plants. References. Address

Box 1489 **Care Rock Products**

Situations Wanted

POSITION WANTED

Manager for Sand and Gravel Co. wants to make connection where he can, if it is desirable, invest some money. He is a young married man with a thorough knowledge and experience of every branch of the sand and gravel business and is capable of managing the entire business. He is gettable immediately. Write now.

Box 1490 **Care Rock Products**

Help Wanted

WANTED

An assistant chemist for laboratory of eastern cement company. Applicants must have had at least one year's experience and thorough chemical training. A college graduate preferred.

Box 1488 **Care of Rock Products**

Have you a plant for sale?
Do you wish to purchase a plant?
Are you in need of a superintendent or manager?
Are you looking for a position as plant superintendent or manager?
Advertise your wants in these columns for quick results.

James N. Hatch, C. E., M. E.
Member A. S. C. E.
CONSULTING ENGINEER
500 Old Colony Bldg., Chicago

Designs and Constructs
Complete Sand and Gravel Screening and Washing Plants.
Stone Crushing and Storage Plants. Conveying Systems. Contractors' Material Plants
Electric Generating Plants and Transmission Lines.
Estimates and Plans Furnished

Robert W. Hunt Jno. J. Cone D. W. McNaugher
ROBERT W. HUNT & CO.
Inspection—Tests—Consultation
Inspection New and Second Hand Machinery, Pumps, Crushers, Steam Shovels, Cars, Locomotives, Rails and Quarry and Contractors' Equipment
INSPECTION AND TESTS OF SAND, GRAVEL, CEMENT, STRUCTURAL STEEL, CASTINGS AND CONSTRUCTION MATERIALS
Cement, Chemical and Physical Testing Laboratories
New York CHICAGO Pittsburgh
St. Louis Kansas City Cincinnati San Francisco

We Design and Equip Complete Plants
for the manufacture of gypsum products, such as wall plaster, moulding plaster, wall board products, gypsum block products, also mixing plants.
We are prepared to furnish complete machinery-equipment and design and furnish plans for the installation. Consult our Engineering Department. Forty years' experience in designing of wall plaster machinery and plants.
The J. B. Ehrsam & Sons Mfg. Co.
Engineers, Machinists and Founders
Enterprise, Kansas

AWS
ALDEN, WILTERDING & SCOTT
CONSULTING ENGINEERS
Seven-Sixty Spitzer Building
TOLEDO OHIO
COMPLETE DESIGNS
Sand and Gravel Plants, Stone Crushing Plants, Conveying and Storage Systems. Hydraulic Dredging and Stripping Plants. Power Plants and Electric Transmission.
WRITE FOR OUR CAR LOADING CHART

The Baldwin Locomotive Works
Philadelphia, Pa.

Steam and Gasoline LOCOMOTIVES
for
Industrial Service

BERRY FLEXIBLE PIPE JOINT

It is not a ball joint, but a "Flexible Pipe Joint"

For Sand and Gravel Hydraulic and Pontoon Lines

Get rid of pipe line troubles. Berry Flexible Joints are made of cast steel and will outwear enough rubber sleeves to save 100% in two years. They connect and disconnect instantly. Patent Locking Device enables one man to lock the two pipes together in a few seconds. Widely used.

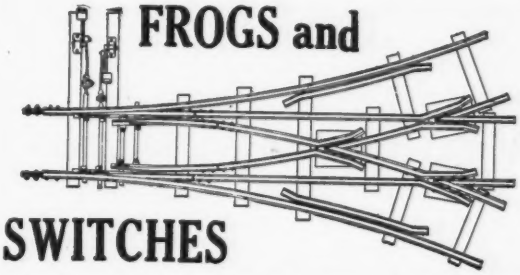
Made with Flanged Ends or Riveted to Pipe

BERRY FLEXIBLE PIPE JOINT CO., Inc.
1604 Ludlow St., Philadelphia, Pa.

BACON-FARREL ORE & ROCK CRUSHING-WORLD KNOWN ROLLS-CRUSHERS

EARLE C. BACON, INC. ENGINEERS
26 CORTLANDT ST., NEW YORK

FROGS and SWITCHES



The Central Frog & Switch Co., Cincinnati, O.

Frogs, Switches, Crossings, Switch Stands, Rails, Angle Bars, Fishplates, Throws, Rail Braces, Tie Plates, Portable Track, Etc., Etc.

ARNOLD & WEIGEL

CONTRACTORS AND ENGINEERS
WOODVILLE, OHIO

Specializing in

The Design of Modern Lime Calcining and Hydrating Plants

SCREENS of All Kinds

Chicago Perforating Co.
2445 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

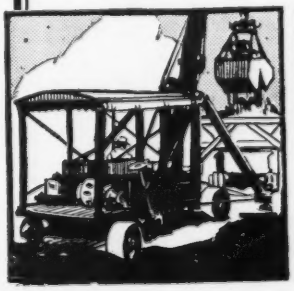
We are dismantling a Clay Plant; been in operation a short time, equipment slightly used, and have for immediate sale:

1 No. 2 Sturtevant Ring Roll Mill.
1 Enclosed Bucket Elevators up to 45 ft. centers 7x14-in. bucket.
2 Double Unit Sturtevant fine Separators.
1 Horizontal Ball Engine 125 H.P.
1 O'Brien Horizontal Boiler 150 H.P.
2 Standard Flour Sackers.
Various small miscellaneous equipment.

PARKER & BAUER
ATTORNEYS-AT-LAW
109 S. Banker St. Effingham, Ill.

"Tie up with" the Handiest Power

BYERS AUTO-CRANE AND REVOLVING TYPES CRANES



You can operate your Byers Crane by the power that's cheapest and easiest to get—electricity, steam or gasoline. Two types—"Auto-Crane" and Full-Revolving. Standard mountings. Write for particulars, describing your work fully.

THE BYERS MACHINE CO.
310 Sycamore St., Ravenna, Ohio
Sales Representatives in 25 Leading Cities

OHIO
LOCOMOTIVE CRANES
OHIO LOCOMOTIVE CRANE CO.
POPLAR ST. BUCYRUS, OHIO

PORTER
LOCOMOTIVES
For Every Purpose
H. K. PORTER COMPANY
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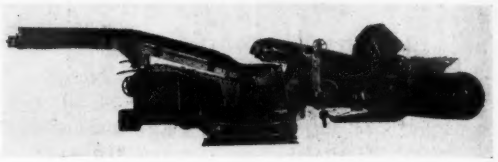
Maddox Foundry & Machine Company
ARCHER, FLORIDA
Manufacturers of the
Abbott Improved Crusher Feeder
Indispensable where clay or sticky material is mined.
We manufacture washing, crushing and drying machinery for phosphate and lime rock, suction and dipper dredges.
We contract for complete plants.

THEY'RE SELF-PROPELLED
MYERS WHALEY SHOVELS
There's no need of pushing or pulling a Myers-Whaley Shovel around. It is self-propelled, adaptable to any gauge track, and loads at the rate of one ton a minute.
Send for catalog
MYERS WHALEY CO., Knoxville, Tenn.



Owen Buckets
combine dollar-saving features of bucket construction which are illustrated in our latest catalogue.
Write for it today.
THE OWEN BUCKET CO.
538 Rockefeller Bldg., Cleveland, Ohio

The House of Dependable Service
HYMAN-MICHAELS COMPANY
Peoples Gas Building
CHICAGO
NEW AND RELAYING RAILS
BRANCH OFFICES
New York, N. Y. 1324 Woolworth Bldg.
Pittsburgh, Pa. 1313 1st National Bank Bldg.
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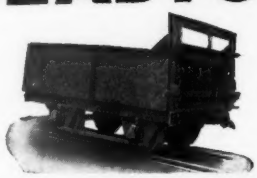
"Hercules Solid Weld" Steam Shovel Chains
COLUMBUS CHAIN HERCULES
Best In the World. Will Actually Wear Out
The Columbus McKinnon Chain Company
Columbus, Ohio

EASTON CARS



Ruggedly constructed Easton Rocker Dump Cars, cars of all types, standard or special, and complete narrow gauge railway equipment from track up—built for enduring service and backed up by thirty years of Easton experience—are available for every car haulage requirement in the rock products industry.
EASTON CAR & CONST'N CO
49 Dey Street, New York Works: Easton, Pa.
Atlanta Boston Chicago Cleveland Dallas Detroit Los Angeles Philadelphia Pittsburgh Salt Lake City

SAUERMAN DRAGLINE CABLEWAY EXCAVATORS
dig, convey, elevate and dump in one operation

Cost data furnished by prominent gravel producers who are using Sauerman equipment backs up our claim that sand and gravel can be excavated and conveyed from pit to plant by one of our drag-line cableway excavators at a lower cost per ton than by using any other equipment or combination of equipment.

Write for Catalog No. 7

Sauerman Bros.
1140 Monadnock Bldg.
Chicago
Also Mfrs. of Power Scrapers

PERFORATED SCREENS
AND STEEL PLATE WORK

W. Toepfer & Sons Co.
Milwaukee Wisconsin

PERFORATED SCREENS

We have the technical knowledge and the equipment that enables us to meet your most exacting needs quickly.

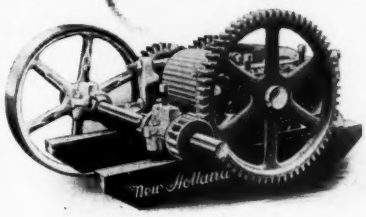
NORTMANN-DUFFKE CO.
1200 27th Ave.
MILWAUKEE, WIS.

Electric Motors

Large Stock of New and Used
Motors and Generators
Repairs for Any Make or Type

Sorgel Electric Co., Milwaukee, Wis.

New Holland Re-crushing Rolls



40½B Geared Rolls

From 1 to 10 ton capacity. Especially designed for fine concrete work and sand. Low in price. Satisfaction guaranteed. Write for catalog. State your requirements.

NEW HOLLAND MACHINE COMPANY
New Holland, Pa., U. S. A.

Perforated Metal Screens
FOR EVERY PURPOSE

We make a specialty of screens for Rock, Gravel and Sand

Diamond Manufacturing Company
Wyoming, Pennsylvania

WHY? — WOOD DRILLS

Because They—
Drill faster
Stand more abuse
Need less repairs
Thrive on hard work

Men who know, prefer "WOOD DRILLS" Because they fill the bill and cut the cost.

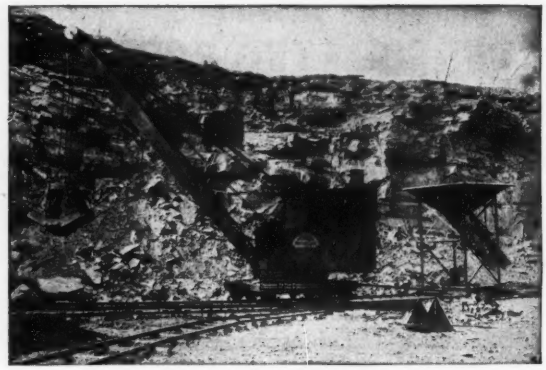
Wood Drill Works
30-36 Dale Ave. Paterson, N. J.

TERRY
FAMOUS DERRICK IRONS, FITTINGS AND ERECTORS' TOOLS

FULL CIRCLE CRANES. "EQUIPMENT THAT LASTS." TIMBER & STEEL DERRICKS.

LET US SOLVE YOUR MATERIAL HANDLING PROBLEMS.

All Types of
Steel and Timber DERRICKS **TERRY**



O. S. DEPENDABLE Locomotive Cranes

reduce expense of handling materials and increase profits and output wherever installed. Catalog No. 18 now ready. Its valuable information will simplify your problems.

ORTON & STEINBRENNER CO.
Chicago, Ill.
Factory—Huntington, Ind.

Universal Crushers

The biggest value for your money. Universal crushers and pulverizers reduce stone to desired size or fineness in a jiffy! Fifteen years of designing and building experience have made possible the exceptional ability of Universals.

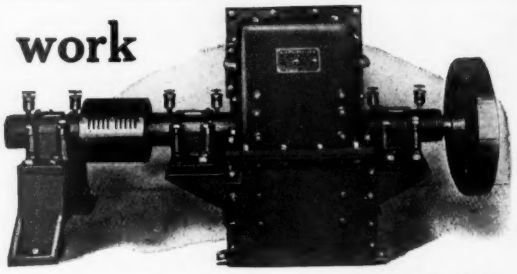
Universal Crusher Co.
225 Third Street
Cedar Rapids, Iowa, U.S.A.

Ask for Folder 1918

By the very nature of the work

it is called upon to perform a pulverizer must be much stronger than the material it handles.

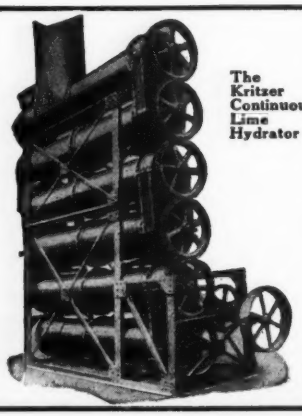
Only STEEL will stand the stress
"K-B" is built ALL-Steel



Catalog with full particulars on request

K-B PULVERIZER COMPANY, Inc., 92 Lafayette St NEW YORK

K-B PULVERIZER



The Kritzer Continuous Lime Hydrator

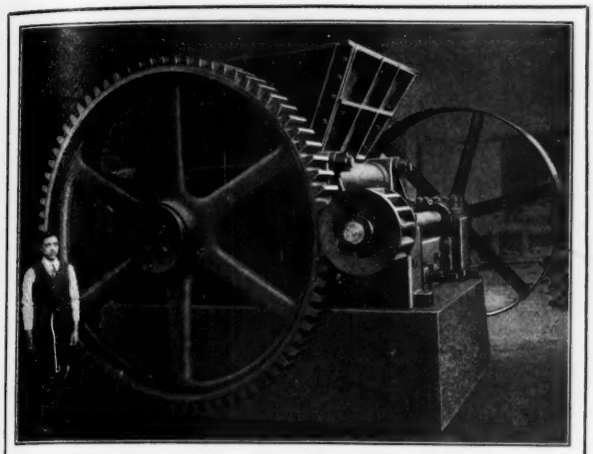
HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

THE KRITZER COMPANY
503 South Jefferson Street CHICAGO, ILL.



If you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher, you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.
Hollidaysburg, Pa.
Screens, Elevators, Conveyors, Rock Washers, etc.

Loading a 30 yd. car in 18 minutes

The ledge of limestone ran 18 to 24 inches thick. On the day that this photo was taken the ERIE loaded out, without blasting, an average of two cars an hour, 30 cu. yds. each.

The owners of this ERIE write us: *"Our ERIE has been used continuously for 3 years, and does as good work now as when first received. We have used it for loading white rock at the quarry, and then in a gravel pit. We recommend the ERIE to anyone needing a shovel."* —McElwrath & Rogers, Corsicana, Texas.

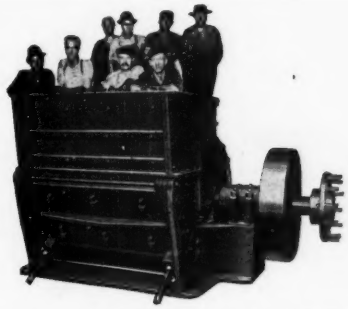
The ERIE has ample strength and power to give steady service in rock work. Also used very profitably for loading gravel from the bank.

Let us send you complete description. Write for Bulletin P-16

Every ERIE Shovel is easily and quickly convertible to a Locomotive Crane. Any ordinary mechanic can make the change in the field, in a few hours.

BALL ENGINE CO., Erie, Pa., U. S. A.
Builders of ERIE Steam Shovels and Cranes
Branch Offices: New York, Boston, Chicago
Representatives throughout the U. S. A.

ERIE Revolving Shovels BALL Engine Co. Erie, Pa.



No. 9 Williams Crusher, capacity 200 tons per hour, of 12-in. limestone to 1½-in. and finer

The Williams Limestone Crusher, used as a secondary breaker, has frequently reduced the number of crushing units from five or six to one or two, effecting remarkable savings in power, labor and maintenance cost.

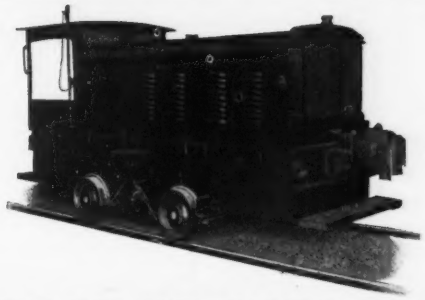
These machines are built in capacities ranging from 30 tons to 300 tons per hour. They are the product of years of specializing in crushing problems. Complete details are given in Bulletin No. 204.

WILLIAMS
JUMBO CRUSHERS

The development of the hinged hammer principle, originated by Williams, has reached 267 United States and Foreign Patents.

WILLIAMS PATENT CRUSHER AND PULVERIZER COMPANY
HINGED HAMMER ESTABLISHED 1871

PLANT AND GENERAL OFFICES:
ST. LOUIS, MO.



CUMMINGS
Gasoline Locomotive

embodies all the proven features of modern gasoline industrial locomotives.

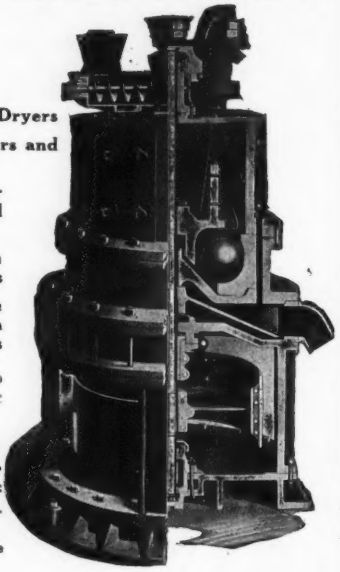
Made in two types and five standard sizes—all sizes friction disc driven, with rolled steel wheels and heavy steel frames—they have proven themselves the most reliable, the most economical, the most efficient gasoline locomotives obtainable today.

Write for bulletin

THE CUMMINGS MACHINE CO.
Minster, Ohio
General Sales Manager, Herbert Crapster
1 Madison Avenue, New York, N. Y.

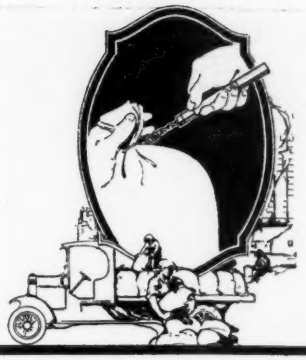
FULLER PRODUCTS
for
FULLEST SATISFACTION

Preliminary Mills
Pulverizing Mills
Crushing Rolls
Direct and Indirect Fired Dryers
Ball and Tube Mill Liners and Partition Plates
Fuller Kinyon System for Conveying Pulverized Materials
Sprockets, Traction Wheels and Roll Heads
All Kinds of High Grade Chilled Charcoal Iron Castings for All Uses



We will be pleased to send catalogue and quote on your requirements.

Fuller-Lehigh Co.
MAIN OFFICE AND WORKS:
Fullerton, Pa., U. S. A.
BRANCHES:
New York Chicago Seattle
Montreal



BATES TIED BAGS
Save Your Money—FREE TRIAL

Your bag tying costs are entirely too high—unless you now use the Bates Wire Bag Tying System. For economy, speed, security and durability you owe it to yourself to investigate the Bates System for your Bag Tying Work. It will pay you to try and then buy.

Write for your FREE Trial Bag Tying Outfit—Today

The Bates Free Trial Bag Tying outfit, containing one Bates Spring Return Tying Tool and 10 each of 4, 4½, 5, 5½ and 6 inch Bates Wire Ties, will be sent you, on receipt of your signed agreement to try this Bag Tying Outfit on your work, and then, within 15 days, send $4.00 for the outfit or return the tool to us. These ties cost you nothing.

BATES VALVE BAG COMPANY
7326 South Chicago Ave.
Chicago, Ill.
110 Great Portland St.
London, W. I., England

LOCOMOTIVE CRANES
CLAM SHELL BUCKETS - SHIPBUILDING CRANES
CAR DUMPERS PILE DRIVERS
THE McMYLER INTERSTATE CO.
CLEVELAND OHIO

Handling Limestone With a Type "J" Locomotive Crane

This crane has proven to the satisfaction of a large number of owners that the heavier crane is the cheapest one to buy for some classes of service.
The Type "J" is only one of a large number of cranes manufactured by this Company.
We also manufacture a complete line of clamshell buckets.

The McMyler Interstate Co., Cleveland, O.

BRANCH OFFICES:
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Chicago, Ill., 812 Edison Bldg.
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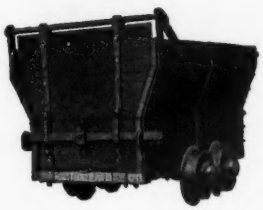
Denver, Colo., 18th and Wazee Sts.
San Francisco, Calif., 766 Folsom St.
New Orleans, La., 444 Maison-Blanche Annex
Boston, Mass., 261 Franklin St.
Birmingham, Ala., Brown Marx Bldg.

WATT CARS

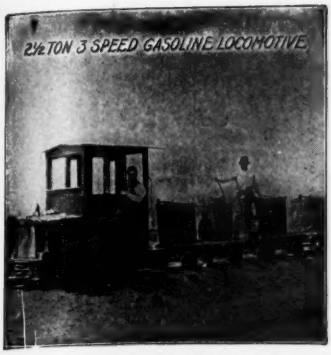


Our factory the largest in the world devoted exclusively to car building

Write today for catalog

The Watt Mining Car Wheel Co.
Barnesville, Ohio

Denver: Lindrooth, Shubart & Co., Boston Bldg.
San Francisco: N. D. Phelps, Sheldon Bldg.
Philadelphia: Edelin & Co., 235 Commercial Trust Bldg.



GEAR AND FRICTION DRIVEN GASOLINE LOCOMOTIVES—2½ TO 25 TONS ON DRIVE WHEEL

WHITCOMB LOCOMOTIVES

IT WILL PAY YOU TO GET OUR PROPOSITION BEFORE YOU BUY

GEO. D. WHITCOMB CO.

MAIN OFFICE AND WORKS

ROCHELLE, ILLINOIS

U. S. A.

STORAGE BATTERY LOCOMOTIVES—1 TO 8 TONS ON DRIVE WHEELS

CROSS ENGINEERING CO. CARBONDALE, PA. PERFORATED SHEET METALS

PERFORATED STEEL SCREENS

The success of any house supplying repair and renewal parts depends on furnishing what is needed quickly and correctly, and of satisfactory quality.

Sixteen years in the Perforated Metal field have given us the experience, equipment and technical knowledge, and three hundred tons or more of Steel Plates and Sheets enable us to fill rush orders promptly.

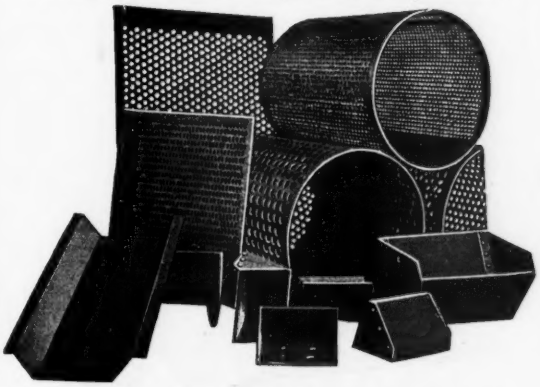
Try us with your next order.

Cross Engineering Company, Offices and Works, Carbondale, Pennsylvania

Perforated Metal Screens

FOR

Stone, Gravel, Sand, Etc.



ELEVATOR BUCKETS

PLAIN AND PERFORATED

General Sheet and Light Structural Work

Hendrick Mfg. Co.

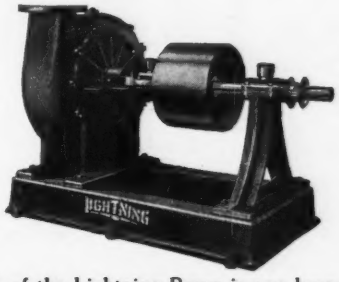
CARBONDALE, PA.

New York Office, 30 Church Street
Pittsburgh Office, 915 Union Bank Bldg.
Hazleton, Pennsylvania, Office, 705 Markle Bank Bldg.

The Lightning Sand Pump

Is No Loafer!

Operate like a flash! Adjusts in a flash! Parts replaced like a flash!



The life of the Lightning Pump is one long, unbroken streak of production.

Simple in design and construction.
Drum removable and adjustable to any position.
Drum plate quickly removable.
Ball thrust bearings, front and rear.
Chilled bumper in sand drum provides long wear.
Bumper quickly replaced.
Detailed description with prices on application.

Address Pump Dept.

Kansas City Hay Press & Tractor Co.

Kansas City, Mo.

THE

"GAYCO-EMERICK"

A New Air Separator

Operating on a New Principle

A Perfect Air Separator at Last
Easily Adjusted for Any Product

From 50 to 350 Mesh

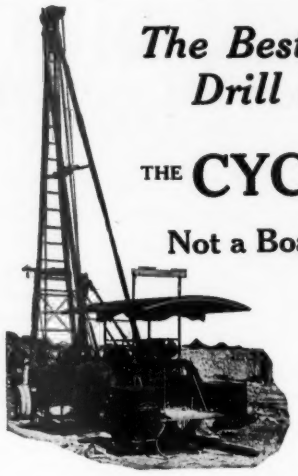
Low Power Large Capacity
Close Sizing

Suitable for use with all types of Grinding Mills, increasing capacity, improving and maintaining fineness.

For Cement, Limestone, Hydrate, Coal, Talc, Gypsum and other ground materials. Produces Agricultural Limestone from Screenings at a very small expense.

RUBERT M. GAY CO.
114 Liberty Street New York City

The Best Blast-Hole Drill on Earth



THE **CYCLONE** No. 14

Not a Boast—A FACT

We will prove the superiority of the No. 14 Drill by placing one of the outfits in your quarry against any or all other makes.

If the Cyclone doesn't out-drill and out-wear all other drills, we will remove it from the work without cost to you.

Our proposition gets below the paint—it eliminates talking points and evaporates hot air. It puts buying on a strictly engineering basis where it belongs.

Furnished in Steam, Gasoline, Compressed Air or Electric Power Traction or Non-Traction

Let us send you full particulars

The Sanderson-Cyclone Drill Co.
ORRVILLE, OHIO
Eastern and Export Office 30 Church St., New York

METRO NITE

for Stucco-

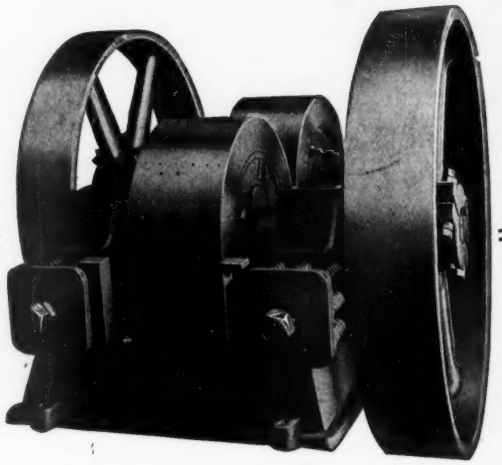
Stucco Buildings, Concrete Blocks or Bricks faced with Metro-Nite are beautiful, artistic and everlasting.

Metro-Nite White is of a crystalline character, really a siliceous dolomite. It is extremely hard, sharp and cleanly graded, making a bright, sparkling face.

Free samples mailed on request.

Two colors—White and Green.

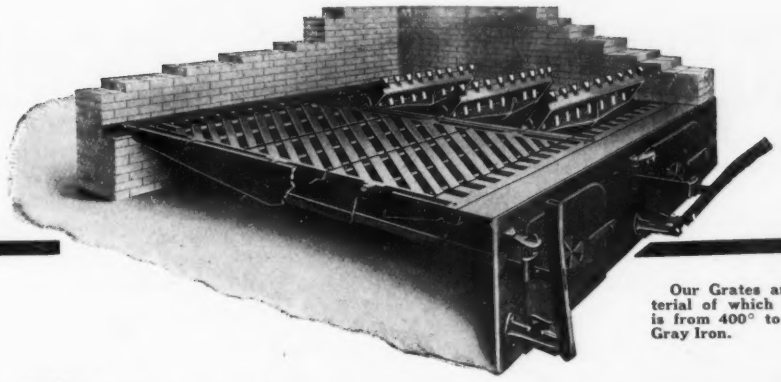
The Metro-Nite Co.
333 Hartford Ave., Milwaukee, Wis.



When you are in the market for Transmission Equipment, Screens, Elevator Buckets or Crushers, and want the best that can be had irrepective of price.

Write for Descriptive Literature

WEBB CITY & CARTERVILLE FOUNDRY & MACHINE WORKS
WEBB CITY, MISSOURI



Our Grates are made of a Material of which the melting point is from 400° to 600° higher than Gray Iron.

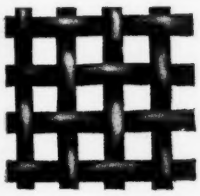
Clean Fires *with* Closed Doors

Besides this, the McGinty is a sifting, shaking and dumping grate combined.

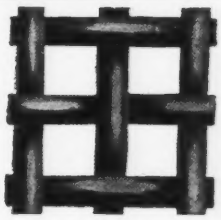
It has more air area, therefore will burn a lower grade of coal than is possible on old style bars, and the upkeep is lower than any other grate.

These features are due to the fact that the McGinty Grate was scientifically designed to meet the requirements of Lime and Hydrating practice, and coupled with the design is a construction that enables the McGinty to withstand a higher degree of heat without warping than any other grate now on the market.

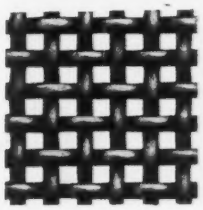
The Kramer Brothers Foundry Company
Dayton, Ohio



3½ Mesh; .135 Wire



2 Mesh; .192 Wire



5 Mesh; .105 Wire

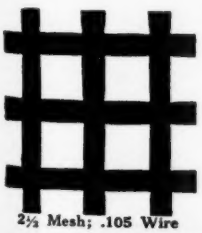
"CLEVELAND" DOUBLE CRIMPED WIRE CLOTH

is unequalled for the screening of sand, gravel, crushed stone, limestone and cement.

With the use of "Cleveland" Double Crimped Wire Cloth comes the assurance of a uniform fineness in your product that will prove beneficial to you in exact proportion to the satisfaction given your customer.

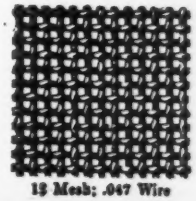
A large stock always on hand. Special meshes made to suit requirements. Prices right

THE CLEVELAND WIRE CLOTH AND MANUFACTURING COMPANY
3573 East 78th St. Cleveland, Ohio



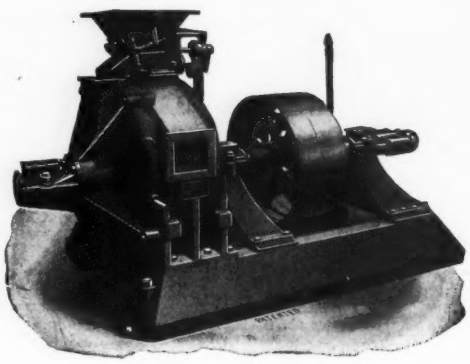
2½ Mesh; .105 Wire

No. 23—Rolled Slot



18 Mesh; .047 Wire

STURTEVANT "ONE-MAN ONE-MINUTE" "OPEN-DOOR" MACHINERY



Vertical Rock Emery Mill

For the Grinding of Soft and Moderately Hard Materials to a Fine Powder Without Screens. Practically the Standard for Burned Lime, Clay, Shale, Chalk, Talc, Salt, Coal, Facings, Ochres, Umber, Siennas, etc.

THE GRINDING STONES

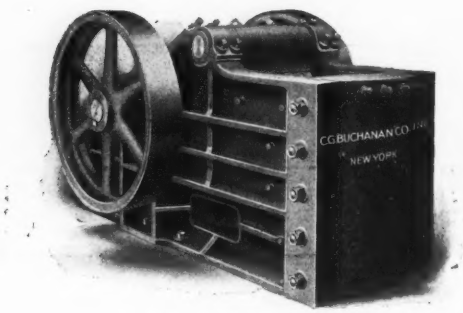
The periphery or skirt is formed of blocks of Rock Emery, because here the hardest work is done; the bosom and the furrows are of softer stone, because these require dressing as they wear.

Do not confuse Emery Millstones with old-fashioned Buhrs or Esopus Stones that require dressing or sharpening every few days.

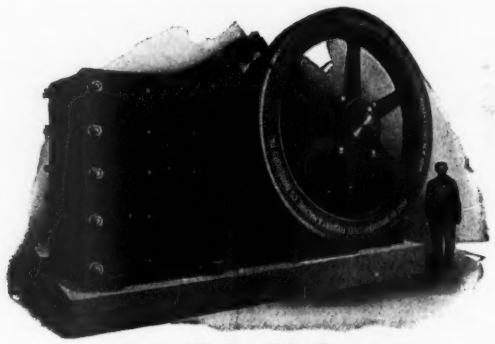
These machines are complete in themselves, and run without vibration on any good mill floor. Right or left hand discharge, as ordered; automatic feed as shown.

STURTEVANT MILL CO., BOSTON MASS.

BOSTON: HARRISON SQ. NEW YORK: SINGER BLDG. CHICAGO: PEOPLES GAS BLDG. ATLANTA: HEALEY BLDG.



Type "C" Panel Side Frame



Type "C" Box Side Frame

BUCHANAN JAW CRUSHERS

ALL STEEL PATENTED

Both "Panel" and "Box" type side frame crushers in stock for immediate shipment. Small crushers in sizes to meet your requirements are also now in stock.

C. G. BUCHANAN CO., INC., 90 West Street, New York

We Design and Build Complete Crushing Plants

CRUSHING MACHINERY, CRUSHING ROLLS, AND MAGNETIC SEPARATORS

When writing advertisers please mention ROCK PRODUCTS

HANDLING THE BANK-RUN

Steadily, continuously and in uniform quantities the belt conveyor delivers material to the screens.

S-A Belt Conveyors are particularly desirable for this service. They are thoroly reliable and require minimum attention.

If you contemplate building a new plant or if you anticipate changes or extensions to your present equipment—communicate with S-A engineers.

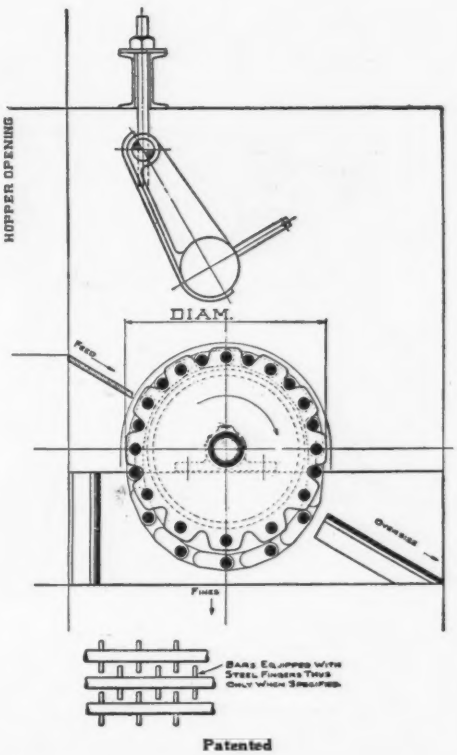
STEPHENS-ADAMSON MFG. CO. AURORA, ILLINOIS

Ross Automatic Drop Bar Grizzly Feeder and Screen

"For use in Mining, Smelting, Sand, Gravel, Crushed Stone, Coke, Coal, Blast Furnaces and numerous other plants."

"Cannot block or choke—will handle material at an even rate for 24 hours a day without labor or attendance."

"Replaces all types of Revolving Screens at a less cost per unit and less cost for horse power with greater tonnage and less repair cost."



Patented

Manufactured and sold exclusively by

Chalmers & Williams, Inc.

1425 Arnold St. Chicago Heights, Ill.

MITCHELL ELECTRIC VIBRATING SCREEN

Judge the MITCHELL by These Three Things

The firm that sells it— The Stimpson Equipment Co. of Salt Lake, one of the largest manufacturers and dealers in machinery in the west, is manufacturer and sole agent of the Mitchell.

The firms that use it— More than 100 concerns in eight different industries have bought the Mitchell. They include such companies as the Utah Copper, American Smelting & Refining, Utah-Salduro, Michigan Limestone & Chemical Co., Birminghame Slag, American Zinc Co., Armour.

The way it is performing— Data is arriving daily at our office showing that the Mitchell is establishing new records in every industry where it is being operated for higher tonnage, lower cost and greater durability.

Your request for complete information about the Mitchell Electric Vibrating Screen will be answered promptly

Stimpson Equipment Company

Felt Building **Salt Lake City, Utah**

Grand Central Palace, New York, N. Y.

SIMPLICITY AND DURABILITY

Traction or Non-Traction

ARE CHARACTERISTIC FEATURES

OF THE ARMSTRONG BLAST HOLE DRILL

There are no flimsy, complicated parts to cause worry, trouble and expense. Has fewer moving and working parts than any similar machine built.

Don't try to get efficiency from a Blast Hole Drill using cast gears, sprockets, chains, cams or superstructures to produce the drilling motion. The simple and durably constructed Overhead Spudding Beam on the "Armstrong" eliminates all of these.

Write today for particulars

Armstrong BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867

ARMSTRONG MANFG. COMPANY

DEPT. A

WATERLOO, IOWA, U. S. A.

BRANCH OFFICES:
Ft. Worth, Tex., 229 W. 15th St.
Scottsville, Kentucky
Baxter Springs, Kansas
New York, 30 Church St.

SALES AGENTS:
H. N. Steinbarger Co., Denver
The Kaufman Co., Los Angeles
Collins Ferguson Co., Seattle, Portland
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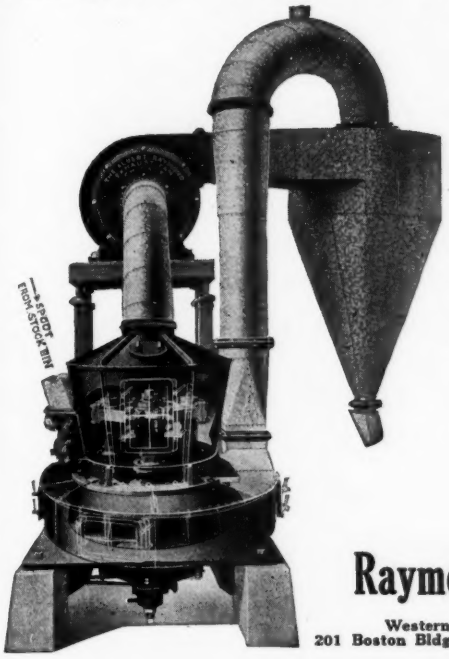
Another cement plant has decided to use Raymond Mills and grind their coal to a fineness of 90 to 92% passing a 200 mesh.



The use of finer coal for burning your cement is well worth your investigation.

Consider a saving of 10 to 15% of your coal at an additional grinding cost of only 25% and we think you can easily see the economy in the finer grinding.

With Raymond Mills you can count on a capacity from each mill of from three to four tons per hour, depending upon grade of coal used, grinding to a fineness of 90 to 92% passing a 200 mesh, which gives a product showing 98 to 99% passing a 100 mesh.

Complete figures will be gladly sent you

Raymond Bros. Impact Pulverizer Company

Western Office:
201 Boston Bldg., Denver, Colo.

1301 North Branch St., Chicago, Ill.

The "Shay" Will Do It

Because of their flexible geared drive, "Shay" engines will get out rock from places inaccessible to rod engines.

All wheels of a "Shay" are drivers—including the tank wheels.

The "Shay" is the most flexible and powerful kind of motive power you can use.

The power is supplied by the three cylinders, producing a constant torque.

LIMA LOCOMOTIVE WORKS, Inc.

LIMA, OHIO **17 E. 42nd St., New York**

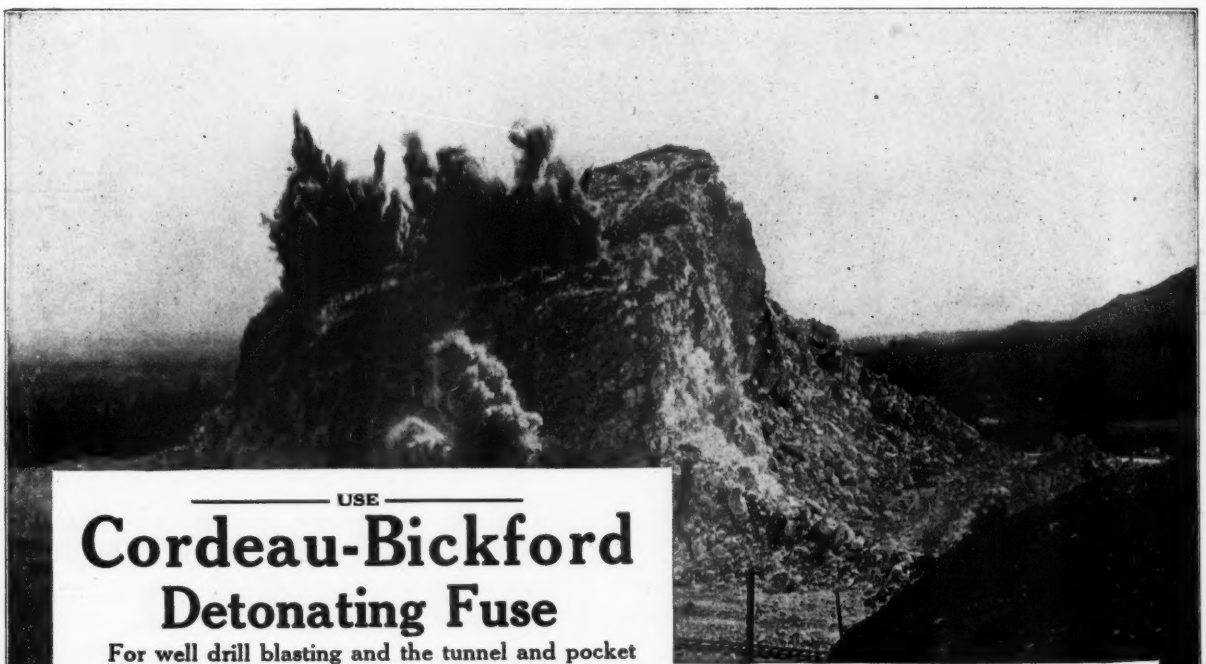
SANDOW
SAND SUCTION HOSE

demonstrates its leadership where unusually hard service and long wear are demanded. Made to fit over corresponding sizes of iron pipe.

ANY SIZE **ANY LENGTH**

Write for prices

Cincinnati Rubber Manufacturing Co.
Cincinnati, Ohio

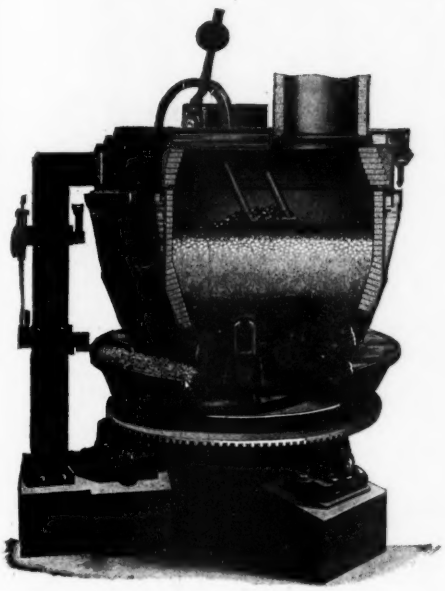


USE
Cordeau-Bickford
Detonating Fuse

For well drill blasting and the tunnel and pocket method of blasting, where large quantities of explosive are to be detonated, use safe, efficient Cordeau-Bickford and get lower blasting costs.

The Ensign-Bickford Co., Simsbury, Conn.
Established 1836 **Original Makers of Safety Fuse**

The Machine of Absolute Satisfaction



Selected by every large purchaser in the steel industry since the armistice. Three recent installations at leading Eastern Lime Plants.

POKERLESS PRODUCER-GAS MACHINE

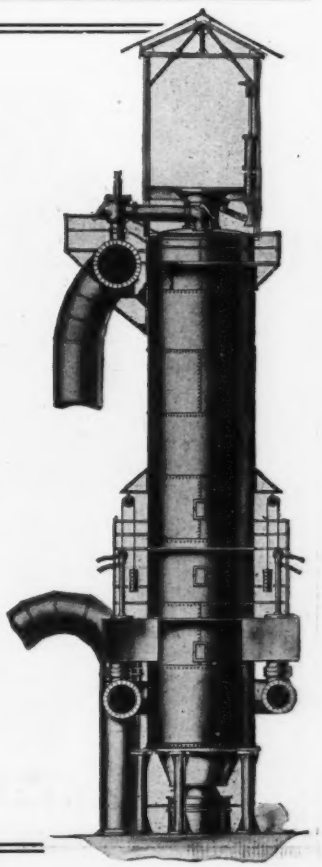
Users everywhere testify with one voice to the superior satisfaction and **low maintenance expense** of this splendid machine. Difference in first cost comes back annually; every detail built for endurance.

Morgan Construction Company
Worcester, Mass.

Continuous Discharge—Gas Fired
LIME KILNS

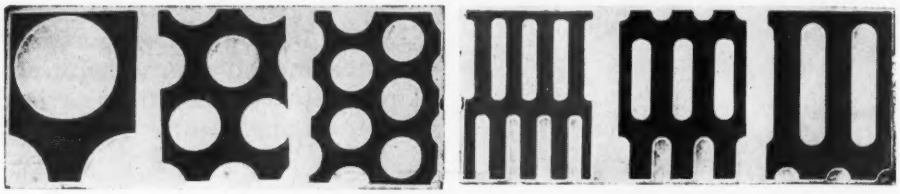
The wastefulness or efficiency of any lime burning apparatus is determined by the amount of fuel per ton of lime produced.

Our Kilns are not an experiment, but have successfully met the test of years of actual service. The design is the work of our Consulting Mechanical and Chemical Engineer, who has had many years of practical operative experience. They embody a number of labor saving devices, and are designed to secure maximum production with minimum fuel consumption; their record in this respect should interest every lime producer in the country.



Glamorgan Pipe & Foundry Company
Lynchburg, Va., U. S. A.
Using the Nationally Famous Virginia Foundry Irons

PERFORATED METALS



All sizes and shapes of holes

For Screening Stone, Gravel, Sand, Cement and all Minerals

Screen Sections—made butt or lap joint in one or more pieces each to fit your frames, for straight or conical screens. Flat plates with or without Bolt holes.

Diagonal Slots for fine screening, have proved to be very satisfactory upon Revolving Screens. We furnish all widths of opening from .008″ to ⅛″ or more.

Write us for anything you need in Perforated Metal.

THE HARRINGTON & KING PERFORATING CO.

New York Office
114 Liberty St.

621 North Union Ave., Chicago, Ill., U. S. A.

One of the
K. V. S. Products

GearLESS
GearLESS
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GearLESS!

Hence no broken gears—and so steady operation—and very low upkeep.

Gearless! And so a crushing speed with either belt or rope drive, that makes possible a tonnage handled otherwise impossible.

Gearless! And so with power applied directly and with unusual flexibility.

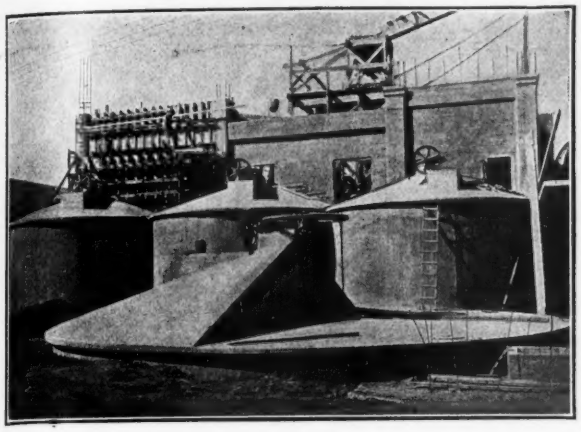
To investigate the record of the KENNEDY GEARLESS CRUSHER is to open up a new efficiency and economy for all intermediate crushing.

Bulletin 2 gives details.

Kennedy-Van Saun Mfg. and Eng. Corporation
Complete Crushing and Screening Machinery for Ore, Rock and Pulp
120 Broadway, New York
Compagnie des Entreprises Industrielles, 40 Rue Des Mathurins, Paris, France

DORR

Save Power in Mixing Your Slurry



The Dorr Slurry Mixer

Following are the power consumptions, both for mechanical operation and air compression, in a Dorr equipped plant:

3 mixers, 20x12 ft.....16.9 H. P.
1 mixer, 30x12 ft.....10.1 H. P.
2 mixers, 34x21 ft.....15.5 H. P.

Average per 1000 cu. ft. tank capacity, 0.7 H. P.

Check these against your present power requirements for mixing—and see what you could save.

Other advantages are: A more uniform mix, low maintenance cost, lower first cost, and a saving in time. Ask for Bulletin 22.

THE DORR COMPANY

ENGINEERS

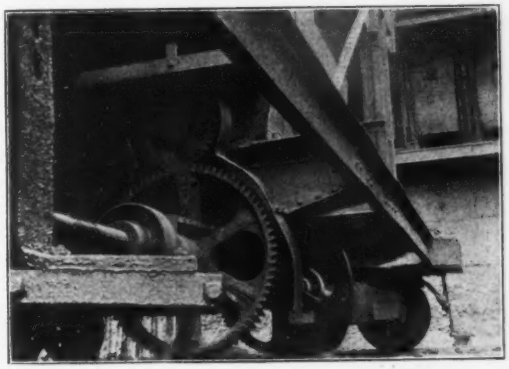
Denver New York London

Research Tests Equipment Design

Heavy-Duty Machine Gears

After experiencing continual trouble with regular gears and pinions, where the average life was only about 11 days and breakage was continuous, a set of "Tool Steel" gears were installed in the same place. Operating company reported that after approximately one year's service, there was no evidence of wear. In this case, the "Tool Steel" gears happened to be even cheaper than the repair parts purchased direct from the machine manufacturer.

The Tool Steel Gear & Pinion Co.
Cincinnati, Ohio



"Tool Steel" drive gears on heavy conveying machine. Untreated steel gears on a duplicate machine in identical service wore 5 times as fast as "Tool Steel"

The standard of Quality
"Tool Steel" gears + pinions.

Buyers' Guide of the Rock Products Industry

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Cleveland, Ohio.
Hercules Powder Co.
Wilmington, Del.

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Carbondale, Pa.
Orton & Steinbrenner
Chicago, Ill.

Buckets
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Cleveland, O.
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Ball Engine Co.
Erie, Pa.
Brown Hoisting Mach. Co.
Cleveland, Ohio.
Browning Co.
Cleveland, Ohio.
Byers Mach. Co., The.
Ravenna, Ohio.
Chisholm-Moore Mfg. Co.
Cleveland, Ohio.
McMyler-Interstate Co.
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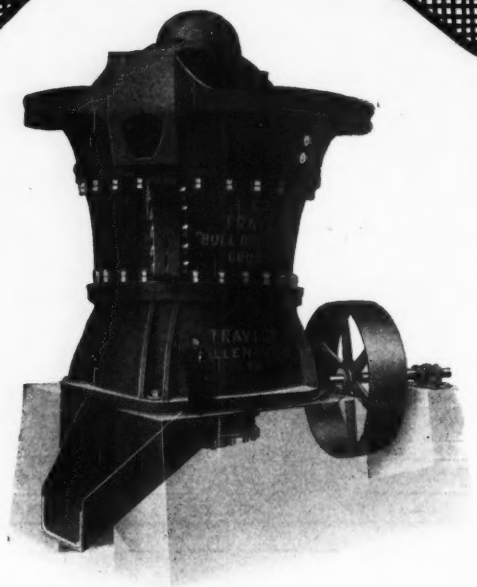

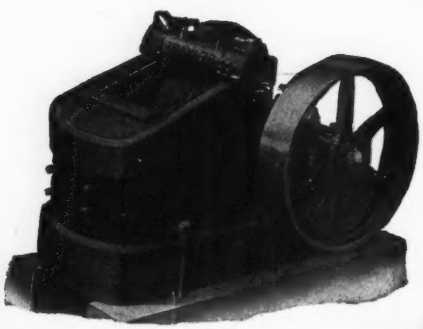

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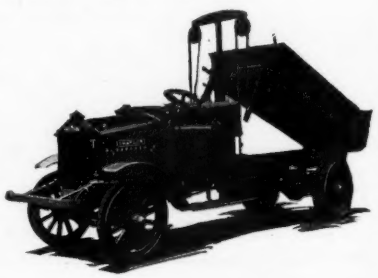

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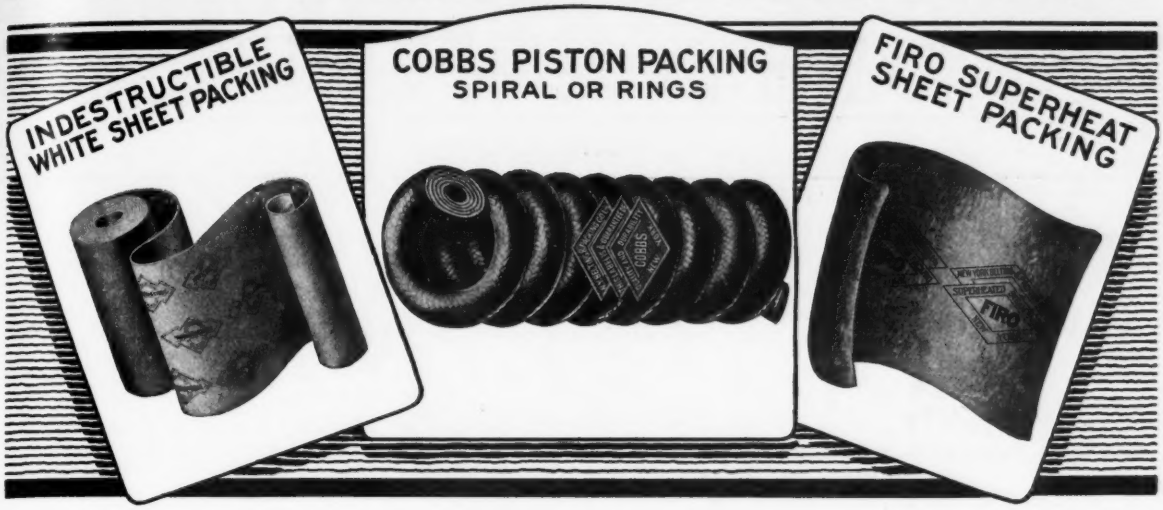

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